

FEASIBILITY AND EFFECTIVENESS OF HEALTHY MENU CHANGES FOR NON-
TRAINEE MILITARY DINING FACILITIES

by

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B.A., Concordia College, 2001
M.B.A., Webster University, 2005

AN ABSTRACT OF A DISSERTATION

submitted in partial fulfillment of the requirements for the degree

DOCTOR OF PHILOSOPHY

Department of Hospitality Management and Dietetics
College of Human Ecology

KANSAS STATE UNIVERSITY
Manhattan, Kansas

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Abstract

The purpose of this study was to assess the food choices and consumption of soldiers and their satisfaction with current and initial military training (IMT) menu standards through a survey and analysis of food selection and consumption. Participants were recruited during lunch periods before and three weeks after implementing IMT menu standards, which are healthier than current menu standards, in an Army dining facility (DFAC). Direct observations, digital photography, and plate waste methods were used to assess soldiers' food selection and consumption. A survey was also administered to determine soldiers' attitudes toward health, nutrition knowledge, reported food selection and consumption behaviors, and overall satisfaction with meals served under the two menu standards. Food selection and consumption were evaluated using the Army's *Go for Green* Nutrition Labeling Program and the Military Dietary Reference Intakes (MDRIs). Descriptive and inferential statistics were calculated to summarize and compare data, and to identify potential associations among variables. A total of 172 and 140 soldiers participated before and after the menu change, respectively. Soldiers' food selection patterns were similar to the proportion of green-, yellow-, and red-labeled items offered in the DFAC under both menu standards and significantly improved after the intervention ($p < 0.001$). Soldiers consumed 886 kcal (38.6% from total fat and 11.2% from saturated fat) and 1784 mg of sodium before the menu change. Three weeks after the change, all figures improved (705 kcals, 31% of kcals from total and 9% from saturated fat, and 1339 mg of sodium) ($p < 0.01$). Overall satisfaction and meal acceptability before and after the intervention were not different, and "food appeal" ratings actually improved. With the exception of sugar-sweetened beverage consumption, attitudes toward health were significantly associated with all reported food behaviors ($p < 0.01$) but not with actual behaviors ($p > 0.05$). Nutrition knowledge significantly influenced some but not all aspects related to attitudes toward health. Perceived hunger levels were positively associated with intakes of calories, protein, total fat, sodium, and cholesterol ($p < 0.05$). Findings suggest that implementing the IMT menu standards in non-trainee Army DFACs is feasible and has the potential to improve the overall healthfulness of soldiers' food selection and consumption.

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Approved by:

Major Professor
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Table of Contents

List of Figures	ix
List of Tables	x
Acknowledgements	xi
Dedication	xii
Chapter 1 - Introduction.....	1
Background.....	1
Statement of the Problem.....	3
Justification	4
Purpose.....	5
Objectives	5
Hypotheses.....	6
Assumptions and Limitations of the Study.....	7
Assumptions.....	7
Limitations	7
Definition of Terms	8
Chapter 2 - Review of Literature	13
Obesity Trends in the United States	13
U.S. Military Obesity Trends.....	15
Energy-Density of Foods and Obesity Trends.....	16
Diet Quality and Food-Away-From-Home.....	19
Strategies to Improve Food Choices Away From Home	21
Nutrition Labeling and Education Act (NLEA).....	21
Nutrition Labeling in Eating Establishments	22
Food Labeling Systems	24
Changes to Foodservice Menu Standards	25
U.S. Military Nutrition Intervention Strategies	27
Calorie Labeling.....	27
<i>Go for Green</i>	27

Initial Military Training Menu Standards	29
Factors Influencing Food Choices	31
Customer Satisfaction and Return Intentions	34
Assessment of Food Intake	36
Chapter 3 - Methodology	49
Introduction.....	49
Data Collection Location and Study Participants	49
Preliminary Investigation of Current Practices.....	51
Recipe Nutrient Analysis	51
Nutrient Analysis and Comparison Between Two Menu Systems	53
Menu Nutrient Comparison with MDRIs	54
Reference Portion Size Determination.....	58
Intervention and Data Collection for Food Selection and Consumption.....	61
Overview	61
Pilot Study	61
Reference Portion Size Determination.....	63
Data Collection	64
Data Analysis	65
Assessment of Soldiers' Perception of Their Health Status and Meal Satisfaction	66
Overview	66
Instrument Constructs	66
Reported Eating Behaviors	66
Nutrition Knowledge	67
Attitudes Toward Health.....	67
Satisfaction with Overall Dining Experience	68
Expert Review and Validity Determination.....	69
Pilot Test	69
Data Collection	69
Data Recoding and Analysis.....	70
Reported Food Behaviors.....	70
Attitudes Toward Health.....	71

Nutrition Knowledge.....	71
Satisfaction with Overall Dining Experience.....	72
Overall Data Analysis	72
Chapter 4 - Factors Influencing Selection and Nutrient Intakes of Non-Training Army Dining	
Facility Patrons	75
Abstract.....	75
Background.....	76
Methods	77
Subjects	77
Instrument and Study Protocol Development	78
Food Selection and Consumption	78
Food Behaviors, Nutrition Knowledge and Attitudes Toward Health Assessment.....	80
Data Collection	81
Data Recoding and Statistical Analysis	81
Nutrient Quality	81
Nutrition Knowledge, Attitudes toward Health, and Reported Behaviors	82
Results.....	83
Factors Associated with Food Selection and Consumption Behaviors.....	84
Reported Food Behaviors and Attitudes toward Health	85
Discussion.....	86
Conclusion	88
Tables and Figures	94
Chapter 5 - Effectiveness of Healthy Menu Changes in a Non-Trainee Military Dining Facility	
.....	100
Abstract.....	100
Introduction.....	101
Methods	102
Subjects	102
Instrument and Study Protocol Development	103
Food Selection and Consumption	103
Customer Satisfaction and Meal Acceptability Assessment.....	105

The Intervention.....	105
Data Collection	106
Statistical Analysis.....	107
Nutrient Quality	107
Results.....	107
Discussion.....	109
Conclusion	111
Tables and Figures	117
Chapter 6 - Summary and Conclusions	121
Summary of Major Findings.....	123
Implications	129
Limitations and Recommendations for Future Research.....	130
Appendix A - Kansas State University IRB Approval	135
Appendix B - Military IRB Approval.....	137
Appendix C - Comparison of Garrison and IMT Menu Standards.....	140
Appendix D - Informed Consent.....	145
Appendix E - Quantitative Survey.....	147
Appendix F - Salad Bar Observation Form	153
Appendix G - Plate Waste Record Sheet	155

List of Figures

Figure 2.1 <i>Go for Green</i> program criteria.....	28
Figure 3.1 Overview of methodology.....	50
Figure 5.1 Summary of changes made to the selected DFAC during the IMT menu standards implementation period	117

List of Tables

Table 3.1 Comparison of nutrient analysis methods using IMT and garrison lunch menus	53
Table 3.2 Comparison of sample lunch menus' nutrient composition using straight average method.....	55
Table 3.3 Selected MDRI's for men and women.....	57
Table 3.4 Comparison of nutrient contents of the menu planned using IMT and garrison menu standards with established MDRI's.....	58
Table 3.5 Consistency and accuracy of selected food items served	60
Table 3.6 Selected nutrition knowledge questions and answers.....	68
Table 4.1 Summary of non-training military diners' lunch meal nutrient intakes	94
Table 4.2 Frequencies and percentages of non-training soldiers' endorsed items for attitudes toward health.....	95
Table 4.3 Correlations and significance between non-training diners' perceived hunger levels and primary outcome variables.....	97
Table 4.4 Multiple regression analysis predicting non-training diners' reported food behaviors from attitudes toward health	98
Table 4.5 Summary of non-trainee DFAC meal offerings based on <i>Go for Green</i> labeling criteria	99
Table 5.1 Difference in nutrient intake before and after implementation of the IMT menu standards.....	118
Table 5.2 Summary of non-trainee DFAC meal offerings based on <i>Go for Green</i> labeling criteria before and after three-week IMT implementation period.....	119
Table 5.3 Summary of mean differences in satisfaction scores for baseline and intervention menu groups.....	120

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Dedication

To my husband and best friend, Khrys: For all of the love and support he provides unconditionally every day.

To my loving parents, Richard and Barbara: For all their dedication, love and encouragement over the past 35 years.

To the men and women of the U.S. Armed Forces: Thank you for the sacrifices you make every day to defend our nation.

Chapter 1 - Introduction

This chapter introduces the dissertation research. Specific sections include background, statement of the problem, research justification, purpose and objectives, hypotheses, assumptions and limitations, and definition of terms.

Background

Adult obesity rates in the United States (U.S.) have doubled over the past 30 years and adolescent and children obesity rates have nearly tripled (Ogden & Carroll, 2010). Obesity is a very serious health problem that is linked to several different co-morbidities, has resulted in a significant increase in health care costs, and is associated with over 100,000 preventable deaths annually (Flegal, Graubard, Williamson, & Gail, 2005). According to the most recent statistics published by the Centers for Disease Control and Prevention (CDC), in 2010 35.7% of adults and 16.9% of children under the age of 18 in the U.S. were obese (Ogden, Carroll, Kit, & Flegal, 2012).

The nation's obesity problem has negatively impacted the U.S. military forces. From 1995 to 2008, obesity rates among current service members increased from 5 to 13% (Bray et al., 2009). Higher attrition rates, an increased number of weight control program enrollees, and decreased availability of potential recruits have all been attributed to increased weight and bodyfat percentages among current, new, and potential military members (Bedno et al., 2010; Hsu, Nevin, Tobler, & Rubertone, 2007; Packnett, Niebuhr, Bedno, & Cowan, 2011).

While there are many factors that can be attributed to America's obesity problem, frequency of foods eaten away from home, which facilitate greater consumption of high calorie, low nutrient-dense foods, have paralleled obesity rates over the last three decades. Although there is no evidence that supports a cause and effect relationship between food-away-from-home (FAFH) consumption and obesity, there is a correlation between the amount of FAFH consumed, weight status, body mass index (BMI) and overall health (Bowman & Vinyard, 2004; Kant & Graubard, 2004; Ledikwe et al., 2006a).

Obesity has been one of the nation's top health concerns for the past several decades. As a result, several programs and initiatives have been developed to address and reverse food-

related trends that are attributable to obesity and other weight-related problems (Story, Kaphingst, Robinson-O'Brien, & Glanz, 2008). Initial programs, such as calorie and food labeling, focused on informing the individual consumer about the nutritional content of food and beverage selections. In 1994, the Nutrition Labeling and Education Act (NLEA), which required most foods contain a nutrition facts label, was implemented to assist individual consumers with making healthy food choices for at home consumption (U.S. Food and Drug Administration, 1994). In 2010, section 4205 of the Patient Protection and Affordable Care Act extended nutrition labeling to eating establishments and required those foodservice companies and vendors with more than 20 locations post calorie information for all standard menu items (Unified Agenda of The Federal Register #0910-AG57, 2011).

Policies and programs focused on educating the individual consumer appear to be effective for some but not others, and overall, it has been ineffective for slowing down obesity rates (Balasubramanian & Cole, 2002; Elbel, Kersh, Brescoll, & Dixon, 2009; Roberto, Larsen, Agnew, Baik, & Brownell, 2010). As a result, programs have been developed and implemented at the environmental level. The intent of these programs is to improve the overall eating environment, or settings where people obtain and consume food (Story et al., 2008).

For example, in 2012, Healthy and Hunger-Free Kids Act (HHFKA) of 2010 required the National School Breakfast (NSBP) and Lunch Program (NLSP) menu standards change to improve the healthfulness of food and beverage choices available to students. Specifically, HHFKA of 2010 limits the amount of sodium, and saturated and trans fats, and increases the amount of fruits, vegetables and whole grains offered to school-aged children participating in the NSBP/NLSP. The revised program ensures that menu standards are synonymous with the most recent Dietary Guidelines for Americans (United States Department of Agriculture Food and Nutrition Service, 2013). Several school districts around the nation have also implemented policies that change menus and food choices offered to students. These policies have eliminated the availability of high calorie, low-nutrient snack foods and beverages on school campuses (Los Angeles Unified School District, 2005; Texas Department of Agriculture, 2010).

The U.S. military has also started to pay more attention to the rising weight and health problems among service members. In order to combat these issues and educate soldiers on the importance of making healthy food choices, several nutrition-related initiatives and programs have been developed and implemented in military dining facilities (DFACs). A majority of these

programs, such as posting calorie and nutrition labels, have focused on educating and assisting DFAC patrons with making informed meal selections (Headquarters Department of the Army, 2012a).

In recent years, the Army has paid a considerable amount of attention on improving the nutrition status and performance of its' initial training population. In 2010, the U.S. Army developed and implemented the Soldier Fueling Initiative (SFI), which was developed to help improve the nutrition and weight status of new Army recruits. There are several tenets of the SFI, and one of them is the Initial Military Training (IMT) menu standards. These prescribed menu standards, which includes standardized menus, recipes, preparation methods, and portion sizes, were implemented in all DFACs that service members in their initial military training (U.S. Army Food Program, 2012). The IMT menu standards are specifically designed to increase the availability of lower calorie, more nutrient-dense foods and beverages, and at the same time, decrease the amount of high-calorie, low-nutrient dense foods and beverages offered at each meal. Those DFACs that do not service soldiers in a training status follow the garrison menu standards. These menu standards are designed to provide soldiers with a variety of food choices; however, compared to the IMT menu standards, the menus, recipes, and preparation methods are less restrictive (Headquarters Department of the Army, 2012a). Soldiers who are in their initial military training are restricted to consuming their meals in the DFAC while soldiers in a non-training status have the option to consume their meals in a DFAC or at another eating establishment (e.g., fast food restaurant) on and off military bases.

Statement of the Problem

Since implementation of the IMT menu standards in 2010, there has been discussion of possibly extending the implementation of these menu standards to include DFACs that service soldiers in a non-training status. While the IMT menu standards are structured to improve the nutrition quality of foods and beverages offered in Army DFACs and can certainly benefit all soldiers, they have only been available in DFACs that service a captive audience of soldiers. It is unknown how well the IMT menu standards would be liked and accepted by soldiers that have an option to eat away from the DFAC, or if implementing these standards would improve the quality of their food selection and nutrient consumption. Dissatisfaction with food choices could result in increased customer complaints and decreased return intentions, which reflect poorly on

Army food services (Ladhari, Brun, & Morales, 2007; Zeelenberg & Pieters, 2002). When non-training soldiers are dissatisfied with foodservice, the meal participation rate falls and at some point, DFAC operations will become unsustainable. In fact, in 2012, it was found that 43% of all Army DFACs failed to meet the 65% utilization rate standard and because of this, several have been closed or consolidated with other DFACs (Headquarters Department of the Army, 2012a; Ryan, 2012; Tate, 2012).

Overall customer satisfaction and menu acceptability are important to Army food service. While the IMT menu standards improve the nutrition quality of foods and beverages offered, foodservice managers may be concerned about how these changes may influence customer satisfaction and meal census. Currently there is only one study evaluating the influence slight modifications to the garrison menu had on food selection and nutrient intakes (Crombie et al., 2013); however, no information exists evaluating soldiers' overall customer satisfaction, acceptability and nutrient consumption resulting from implementation of the IMT menu standards, both in trainee and non-trainee DFACs.

Justification

Increased customer satisfaction has been shown to improve acceptability and revisit intentions within the food service industry (Andaleeb & Conway, 2006; Kim, Ng, & Kim, 2008). However, it has also been shown that other motives, such as health and convenience, can influence food choice and acceptability (Deshpande, Basil, & Basil, 2009; Glanz, Basil, Maibach, Goldber, & Snyder, 1998; Sun, 2007). Knowing and understanding soldiers' satisfaction with and acceptability of different menus, and what other factors influence their food choices would provide valuable information to Army leaders and food service managers. Results from this type of evaluation can assist them with determining the most appropriate menu standard to implement in DFACs servicing a non-captive audience of soldiers.

Diets containing mostly lower-calorie, more nutrient dense foods and beverages have been linked to high diet quality (Ledikwe et al., 2006b). While it can be assumed that the IMT menu standards provide a greater number of foods and beverages that are associated with high quality diets because of the self-service setting, it is unknown what the nutritional benefits are from implementing these types of menu standards. Both Army leaders and food service managers may remain skeptical about implementing these standards, especially if there is no

proven nutritional benefit of one menu standard versus another. Knowing if IMT menu standards influence the overall diet quality of non-training soldiers would help determine whether it would be nutritionally beneficial to implement the IMT menu standards in non-trainee DFACs.

This research was conceptualized on the basis of two primary interests: identifying factors that influence soldiers' food selections, customer satisfaction and meal acceptability; and assisting the Army with determining if the IMT menu standards are appropriate for non-trainee DFACs that is of optimal nutrition quality and ensures continued use of and satisfaction with Army DFACs.

Purpose

The purpose of this study was to assess non-trainee soldiers' food choices and consumption and their satisfaction with current garrison and IMT menu standards through a quantitative survey and analysis of food selection and consumption before and after a three-week implementation of IMT menus. The relationship between soldiers' food selection and consumption, and their satisfaction and acceptability of the two different menus were evaluated. The first component of this research assessed the difference in food selection and consumption between the two meals prepared under different menu standards using digital photography, direct observation, and plate waste methods. The second component evaluated soldiers' reported food behaviors, nutrition knowledge, attitudes toward health, customer satisfaction, and menu acceptability to determine if other factors influenced their food behaviors. Based on the results of assessment of food selection and consumption, and the overall customer satisfaction and acceptability of the two menus, recommendations were made for determining if IMT menu standards were to be implemented in non-trainee DFACs. Results were to be presented to Army nutrition and food service leaders.

Objectives

The specific objectives for this research were to:

1. Assess soldiers' satisfaction with and acceptability of the current garrison menu standards using a survey.
2. Determine soldiers' food selections, and food and nutrient consumption before implementing the IMT menu standards.

3. Reassess soldiers' satisfaction, and food selection and consumption of the IMT menu standards after three weeks of IMT menu implementation.
4. Evaluate the relationships between reported food behaviors, and actual food selection and consumption based on soldiers' demographic characteristics, nutrition knowledge and attitudes toward health.

Hypotheses

Because there was no previous research indicating potential outcomes of the intervention, this research was conducted with the following null hypotheses.

- Hypothesis 1: There will be no difference in soldiers' satisfaction with the military foodservice before and after implementation of the IMT menu standards.
- Hypothesis 2: There will be no difference in soldiers' acceptability of the food choices offered before and after implementation of the IMT menu standards.
- Hypothesis 3: There will be no difference in soldiers' nutrient component of foods selected before and after implementation of the IMT menu standards.
- Hypothesis 4: There will be no difference in soldiers' nutrient component of foods consumed before and after implementation of the IMT menu standards.
- Hypothesis 5: There will be no difference in soldiers' reported food behaviors based on soldiers' nutrition knowledge.
- Hypothesis 6: There will be no difference in soldiers' nutrient component of foods selected based on soldiers' nutrition knowledge.
- Hypothesis 7: There will be no difference in soldiers' nutrient component of foods consumed based on soldiers' nutrition knowledge.
- Hypothesis 8: There will be no difference in soldiers' reported food behaviors based on soldiers' attitudes toward health.
- Hypothesis 9: There will be no difference in soldiers' nutrient component of foods selected based on soldiers' attitudes toward health.
- Hypothesis 10: There will be no difference in soldiers' nutrient component of foods consumed based on soldiers' attitudes toward health.
- Hypothesis 11: There will be no difference in soldiers' reported food behaviors selected based on soldiers' demographic characteristics.

- Hypothesis 12: There will be no difference in soldiers' nutrient component of foods selected based on soldiers' demographic characteristics.
- Hypothesis 13: There will be no difference in soldiers' nutrient component of foods consumed based on soldiers' demographic characteristics.

Assumptions and Limitations of the Study

Assumptions

There were several assumptions established for this study. First, it was assumed that participants responded to items on the survey to the best of their knowledge. Second, all items and scales used in the survey were appropriate and accurately captured information for variables of interest. Third, participants did not behave differently because of the nature of the research or because they were participating in research. Fourth, it was assumed the established reference portions provided accurate estimations of typical portion sizes served and standard recipes were followed accurately. Fifth, a one-day food intake observation conducted for each set of menu standards accurately reflected participant's typical food selection and consumption. Lastly, it was assumed that study participants and the selected DFAC were good representative samples of soldiers in a non-training status and Army non-trainee DFACs.

Limitations

There were several limitations taken into consideration when initiating the study and also at the conclusion of data analyses. First, due to time and financial constraints, the IMT menu was implemented for a period of three weeks. This may not have been a sufficient amount of time for participants to form opinions about the menus and to determine the effects this menu had on outcomes variables. Second, due to logistical challenges associated with changing beverage options temporarily and DFAC management staff's concern with the potential negative impact on customer satisfaction; beverage choices remained unchanged during IMT menu implementation. The DFAC management staff was also concerned that changing breakfast choices to meet IMT menu standards would have a negative impact on DFAC census. Therefore, only lunch and dinner choices were modified to meet the IMT menu standards during the three-week study period. Full implementation of IMT menu standards at all meals including beverage changes would reveal the true impact of these changes. Lastly, there may be

nonresponse bias in our data. Because soldiers' participation in this research was voluntary, those with a greater interest in health and nutrition may be more interested in participating in the research than those who do not. In other words, soldiers who participate in this research may be significantly different from others who refuse to participate. Data from those who did not choose to volunteer were not reflected in the study, and therefore, results need to be interpreted with caution.

Definition of Terms

Army Regulation: Army publications that establish policies and regulations, and provide the administrative procedures necessary to implement policies (Headquarters Department of the Army, 1990).

Army Weight Control Program: A regulation that establishes a weight control program and guidance for body fat standards in the Army (Headquarters Department of the Army, 2006).

Garrison Menu Standards: Specific meal standards established for DFACs servicing soldiers in a non-training status on a permanently established military installation (Headquarters Department of the Army, 2012a).

Initial Military Training (IMT): The term that encompasses all initial Army training including enlisted, warrant officer, and officer (Headquarters Department of the Army, 2012b). Two components within IMT are:

- a) *Advanced Individual Training (AIT):* Training given to enlisted personnel, after completion of IET, to qualify for the award of a military occupation skill (MOS).
- b) *Initial Entry Training (IET):* Training presented to new enlistees with no prior military service.

Initial Military Training (IMT) Menu Standards: Specific meal standards established for DFACs servicing soldiers in their initial military training on a permanently established military installation (U.S. Army Food Service, 2012).

Soldier in a non-training status: A soldier that has successfully completed all initial military training requirements and has been assigned a military occupation skill (MOS) (Headquarters Department of the Army, 2012b).

Soldier Fueling Initiative (SFI): An Army program developed to establish a feeding standard for soldiers in an initial military training status (U.S. Army Food Program, 2012).

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Chapter 2 - Review of Literature

The purpose of this study was to assess non-training soldiers' food choices and consumption and their satisfaction with current and IMT menu standards through a quantitative survey and analysis of food selection and consumption. This chapter provides information and a summary of previous literature surrounding 1) obesity trends in the United States (U.S.) and the impact on the U.S. military; 2) changes in the overall eating environment and individual dietary habits attributable to obesity; 3) effectiveness of both national and military nutrition-related intervention strategies employed to address individual and environmental dietary trends; 4) factors influencing the healthfulness of individuals' eating habits and their acceptance of healthy food choices; 5) the influence of customer satisfaction on return intentions; and 6) methods used to assess food intake.

Obesity Trends in the United States

Obesity continues to be a prevalent, wide spread, and serious health problem in the United States. According to the Centers for Disease Control and Prevention (CDC) (2012), obesity refers to body weight greater than what is considered healthy for a given height and is determined by calculating body mass index (BMI). BMI is the measure of an individual's weight in relation to their height. A BMI between 19 and 24.9 is considered normal; those with a BMI 25-29.9 are categorized as overweight; and an individual is considered obese if they have a BMI greater than 30 (Ogden & Carroll, 2010).

In 2010, 35.7% of all adults, and 16.9% of adolescents and children were obese (Ogden, Carroll, Kit, & Flegal, 2012). This equates to more than one in every three adults, and one in every six adolescents and children in this country. In 2011, obesity prevalence was at least 20% in all 50 states and 12 states had obesity rates greater than 30% (CDC, 2011). Although prevalence is greater among certain population demographics, such as non-Hispanic blacks with reported obesity rates of 40.4%, overall, obesity is high among all races, genders and age groups.

The prevalence of obesity has steadily increased over the past several years. In 1980, only 15% of the U.S. adult population, and less than 6% of children and adolescents, were considered obese. Two decades later, adult obesity more than doubled to 30.9% and child and adolescent obesity nearly tripled to 15.4% (Ogden & Carroll, 2010). In a study published in

2008, Wang and colleagues examined the National Health and Nutrition Examination Study (NHANES) data collected between 1970 and 2004 to predict future obesity prevalence. Results from their study indicated that if the number of obese Americans continues to increase at these observed rates, by 2030, 86.3% of adults would be considered overweight and 51.1% would be obese. Additionally, nearly one-third of all children and adolescents will be obese (Wang, Beydoun, Liang, Caballero, & Kumanyika, 2008).

There are a multitude of studies and CDC reports that evaluate obesity prevalence. Although these studies and reports provide information regarding the extent of the obesity problem, they do not indicate the rate at which individuals are becoming obese. A recent study published used the 2009 Behavioral Risk Factor Surveillance System (BRFSS) to determine occurrences of adult obesity and morbid obesity. In 2009 alone, the incidence, or rate at which those becoming obese and morbid obese, was approximately 4.0% and 0.7%, respectively. Incidence of obesity was highest among those ages 18-29, which was estimated to be 6.4% (Pan, Freedman, Gillespie, Park, & Sherry, 2011).

Obesity has been shown to be associated with several negative health consequences and thousands of preventable deaths. Guh et al. (2009) conducted a meta-analysis to determine those co-morbidities found to be associated with being overweight or obese. The results of the analysis indicated that excessive body weight can increase the risk for 18 different co-morbidities including type II diabetes, several forms of cancer, cardiovascular disease, asthma, gallbladder disease, osteoarthritis and chronic back pain. A study published in 2005 revealed that, when compared to a normal BMI, obesity was related to increased mortality. Using data derived from NHANES published 1992-1994 and including follow-up data collected 1999-2002, it was estimated that in 2000 the number of excess deaths associated with obesity was over 110,000 (Flegal, Graubard, Williamson, & Gail, 2005).

Treating co-morbidities developed by obese individuals has become a serious financial burden and has greatly increased national medical spending. Finkelstein, Trogon, Cohen, and Dietz (2009) evaluated the economic cost associated with obesity using Medical Expenditure Panel Surveys (MEPS) and National Health Expenditure Accounts (NHEA) from 1998-2006. The results from their study revealed that per capita medical spending for obese people was 42% (\$1,429) higher than those of normal weight. Annual medical spending increased 2.6% from 1998-2006 and based on these results, the authors estimated that annual medical spending would

exceed \$147 billion by 2008. It was determined that the main driver for increased annual medical spending for obesity was not per capita costs, but the increased prevalence of obesity.

From an employer standpoint, obesity is very costly. In a study published in 2010, Finkelstein and colleagues evaluated costs related to lost productivity among U.S. employees because of being overweight or obese. Using the 2006 MEPS and 2008 National Health and Wellness Survey (NHWS), it was found that productivity costs rose with increasing BMI, and in 2008 it was estimated that the overall cost of obese employees in America was \$73.1 billion. This is the amount of money it would take to hire an additional 1.8 million workers earning a salary of \$42,000 (Finkelstein, DiBonaventura, Burgess, & Hale, 2010).

U.S. Military Obesity Trends

The problem of obesity has not only significantly increased among the U.S. population but also among military personnel. This overall increased prevalence of obesity has led to a heightened concern for ensuring a fit and healthy military forces. From 1995 to 2008, obesity rates among service members 20 years and older increased from 5% to 13%. In 2008, 15% of males and 20% of female military personnel reported having difficulty meeting weight and/or body fat standards (Bray et al., 2009).

Weight and body fat standards are established for U.S. military personnel to ensure the nation's defense is comprised of fit and healthy individuals capable of meeting the physical demands associated with serving in the military. These standards must be met in order to enter military service and must be maintained throughout one's military career. Failure to meet these standards can result in delayed career progression and/or discharge from military service (Headquarters Department of the Army, 2013).

Over the past several years, there has been a substantial increase in the number of potential service members unable to meet entrance level weight and body fat standards. According to a previous study that examined data from the 2001-2004 NHANES, depending on the branch of service, 20.8% to 53.7% of women and 17.9% to 33.3% of men ages 17 to 24 were ineligible for enlistment (Yamane, 2007). In another study, 756,269 applications from Military Entrance Processing Stations (MEPS) were reviewed to evaluate overweight and obesity trends among civilian applicants from 1993-2006. Using BMI to determine overweight or obesity, 25.6% of 18-year old applicants were considered overweight in 1993. By 2006, this increased to

33.9%. Likewise, in 1993, 2.8% of applicants were considered obese, and by 2006, this percentage increased to 6.8% (Hsu, Nevin, Tobler, & Rubertone, 2007).

Obesity has not only impacted the military's potential recruitment pool, but has also influenced the number of current military personnel unable to progress in their career and/or not being retained because of failure to meet weight and body fat standards. Bedno et al. (2010) published a study in 2010 that evaluated the impact the Army's Assessment of Recruitment Motivation and Strength (ARMS) pilot program had on weight control program enrollment. The ARMS program was piloted at six different MEPS stations from 2005 to 2006 and provided overweight applicants a waiver to enlist into the military as long as they passed a basic physical fitness test. A total of 10,213 applicants, both normal and overweight, were enrolled in the program during the pilot test time period. Results from the study evaluating this program found that 23% of participants provided a waiver were enrolled in the Army's weight control program within the first 15 months of enlistment, while only 3% of those that did not require a waiver were enrolled. A study published in 2011 examined MEPS data from 2002 to 2006 to evaluate the impact BMI had on attrition rates of enlistees within their first 12 months of service. Using odds ratios, it was found that those that were placed in the ≥ 34 BMI had the greatest odds for being discharged within their first year of service (Packnett, Niebuhr, Bedno, & Cowan, 2011).

Energy-Density of Foods and Obesity Trends

The concept of weight management is fairly straightforward and simple, and encompasses two primary factors: calorie (energy) intake and calorie (energy) expenditure. Weight gain occurs when calorie intake consistently exceeds calorie expenditure; weight loss is experienced when calorie intake is consistently less than calorie expenditure; and weight management is achieved when calorie intake is approximately the same as calorie expenditure. Although there may be other factors contributing to weight management, the major contributing factor to increased body weight is a positive energy balance (The American Dietetic Association, 2009).

Unless significant activities are conducted on a regular basis, the likelihood of consuming excessive calories and experiencing weight gain increases as the overall energy density of the diet increases. Energy density can be defined as the amount of energy (or calories) contained in a particular volume or amount of food or beverage, and is typically measured as kilocalories per

gram (kcal/gram) (Rolls, 2009). Energy-dense foods tend to have low water content and greater amounts of sugar and fat, the most energy-dense macronutrient. On the contrary, a large percentage of most low energy-dense foods are high in water, which significantly lowers their overall energy content, and many of these foods are also low in fat (Drewnowski & Specter, 2004). Examples of energy-dense foods would be potato chips and chocolate cake, while examples of low energy density foods are fruits and vegetables.

Energy density of diet is influenced by the energy density of foods consumed and less by volume of food intake. Marti-Henneberg et al. (1999) revealed in their study that adults consume a consistent food volume daily; however, the overall energy density of the adult subjects' diets depended on their macronutrient content. In a study using within-subject, repeated measures design, normal-weight female subjects were served lunch and dinner entrees that were of equal volume but varied in energy density. Results from the study indicated not only did subjects consume significantly more calories when they were served high energy density meals, but also that the energy density of the entrees did not significantly influence subjects' meal or daily food volume intake (Bell, Castellanos, Pelkman, Thorwart, & Rolls, 1998). In a similar study using both lean and obese females, Bell and Rolls (2001) found that the energy density of meals significantly influenced energy intake regardless of the individual's BMI or usual daily fat intake.

It has been clearly shown that even though the energy density of food increases, food volume does not appear to decrease. Furthermore, several studies have found that when presented larger portions of energy-dense foods, individuals have a tendency to consume larger amounts of food and energy. In one study, male and female subjects were presented in a laboratory setting with portion sizes of macaroni and cheese that differed in volume. Those presented with the largest portion ate, on average, 30% more food and energy than those presented with the smallest portion (Rolls, Morris, & Roe, 2002).

Two studies that investigated the influence portion sizes had on intake in natural settings, such as a restaurant, also discovered that portion sizes significantly influences the amount of food and energy consumed. Diliberti, Bordi, Conklin, Roe, and Rolls (2004) found that those served a pasta dish that was 150% of the normal portion consumed, on average, 43% more energy than those served the normal portion (100%). In another study, participants were given either a medium or large bucket of either fresh or stale popcorn. Results from the study found

that those given large buckets of popcorn ate 33% more popcorn if popcorn was stale and 43% if popcorn was fresh compared to those given a medium size bucket (Wansink & Kim, 2005).

While high energy density foods tend to increase diet energy density and food volume intake, low energy density foods have the opposite effect. Studies have found that inclusion of low energy density foods tend to lower overall energy intake without lowering usual food volume intake nor influencing overall satiety. Rolls, Roe, and Meengs (2004) found that subjects' meal intake (total kilocalories) decreased, on average, by 10% on average, when provided a low energy salad before the main course compared to subjects not provided a first course salad. In another study, subjects were either provided two low energy soups, two snacks, or one low energy soup to consume each day along with their normal intake. Rolls, Roe, Beach, and Kris-Etherton (2005) found that subjects provided a low calorie soup twice a day decreased daily energy consumption and lost the most weight after 12 months compared to the control, one-soup and two-snack groups.

In addition to the large body of evidence that has shown the influence energy density of food has on overall diet, several studies support the correlation between the energy density of diets, nutrition quality, weight status and BMI. Kant and Graubard (2005) examined data from the 1988-1994 NHANES III and found that 1) more energy density diets yielded greater intakes of total calories and fat, and lower intakes of nutrient-dense foods such as fruits and vegetables; and 2) higher energy-dense diets were associated with higher BMIs. Marti-Henneberg et al. (1999), although not the focus of their study, found a strong positive relationship between their adult subjects' BMI and the overall energy density of their diets. Two cross-sectional studies using data collected from the Continuing Survey of Food Intakes by Individuals (CSFII) found that those consuming lower-energy diets had higher intakes of essential nutrients, and fruits and vegetables, and lower intakes of total calories, fat and non-water beverages, such as soda (Ledikwe et al., 2006b). Additionally, these authors found that 1) people with a normal body weight consumed lower energy-dense diets than obese individuals; and 2) those who consumed the most fruits and vegetables had the lowest energy-dense diets and the lowest prevalence of obesity (Ledikwe et al., 2006a).

Diet Quality and Food-Away-From-Home

In the past 30 years, the frequency of consuming food-away-from-home (FAFH) has been a rapidly growing trend among the American populous. The United States Department of Agriculture (USDA) Economic Research Service (ERS) defines food-at-home (FAH) expenditures as those made on foods that will be prepared at home or any other place except for the location where the food was sold. FAFH is defined as food that is purchased and consumed at the location from which it is sold, such as a restaurant or fast-food location. FAFH also includes those food purchased that are ready for immediate consumption (e.g., pizza, bakery items) but may be consumed in a location other than the premise from where it is purchased (USDA ERS, 2010). According to the ERS, in 1970, FAFH comprised of only 26% of all food expenditures. Thirty years later, this percentage had risen to nearly 41% (Lin, 2012), and by 2007 reached 42% (Clausen & Leibtag, 2008). After analyzing the 1987 and 1992 National Health Interview Survey (NHIS) and 1999-2000 NHANES data, Kant and Graubard (2004) found that 36% of the population reported consuming at least three commercially prepared meals each week in 1987. This percentage increased to 41% by 2000.

Because of the increased frequency of American's FAFH consumption, less energy is being consumed from food prepared at home and more energy is being obtained from FAFH. A comparison of data from the 1977-78 Nationwide Food Consumption Survey (NFCS), and the 2005-06 and 2007-08 NHANES revealed that in 1970, only 18% of America's total daily energy consumption came from FAFH; by 2008, nearly 33% or one-third of total daily calories came from food-away-from-home (Lin & Guthrie, 2012).

Increased frequency of FAFH and greater reliance on these types of foods for energy has led to increased concern regarding rising obesity rates and the overall quality of Americans' diets. It was found as early as the mid-1980's that FAFH were more energy dense and less nutritious than foods prepared at home (Ries, Kline, & Weaver, 1987). However, the nutrition consequences associated with consuming FAFH did not become more prevalent until FAFH started to become a greater percentage of the overall diet. A study that compared data from the 1977-78 Nationwide Food Consumption Survey (NFCS) and 1994-96 Continuing Survey of Food Intakes by Individuals (CFSII) found that not only had the percentage of FAFH consumption increased, but also the nutritional quality of FAFH was poorer than FAH. When compared to FAH, FAFH was higher in fat, saturated fat, sodium and cholesterol, and lower in

dietary fiber, calcium and iron (Guthrie, Lin, & Frazao, 2002). This was echoed in a more recent nutrient comparison of FAFH and FAH conducted using 2005-08 NHANES. Lin and Guthrie (2012) revealed that percentage of total calories from saturated fat was higher in FAFH; it contained, on average, 500 milligrams more sodium per 1000 calories, provided 20 milligrams more cholesterol per 1000 calories, and had 12% less fiber than FAH. Consuming one meal away-from-home reduced average dietary density of whole fruit by 23.5%, whole grains by 20.8% and vegetables by approximately 21% (Todd, Mancino, & Lin, 2010).

When compared to FAH, the energy density of FAFH is remarkably higher. Todd et al. (2010) evaluated data from the 1994-96 CSFII and the 2003-04 NHANES and found that consuming one breakfast meal away-from-home added 74 calories to the daily energy intake, one lunch meal added 158 calories, one dinner meal added 144 calories and one away-from-home snack added 107 calories. In a study using data from the 1994-1996 CSFII that looked specifically at fast food consumption in adults, it was found that those who reported consuming fast food ate 207 more calories than those that reported consuming no fast food. Also, the overall energy density of the diet was higher among fast food consumers than non-consumers (Bowman & Vinyard, 2004).

Currently, there is no direct evidence that supports the fact that FAFH causes obesity. However, there is a significant amount of evidence that has demonstrated correlations among diet quality, amount of FAFH consumed and obesity rates. Mancino, Todd, and Lin (2009) evaluated 2003-04 NHANES and found that those with a BMI greater than 30 reported consuming 240 more calories on days when FAFH was consumed, while those with a normal BMI reported consuming only an additional 90 calories. Bowman and Vinyard (2004) found that those considered overweight or obese had a greater odds of being fast food consumers compared to those with normal BMIs. After accounting for the extra calories reported being consumed with FAFH, Todd et al., (2010) calculated that eating one meal away-from-home each week can lead to, on average, two pounds of weight gain each year. In a study that focused specifically on children and adolescents, and fast food consumption, it was found that after comparing baseline and one-year survey data, participants that reported increasing consumption of fast food gained weight over and above what was normally expected (Taveras et al., 2005).

Strategies to Improve Food Choices Away From Home

FAFH is available for consumers in many different physical eating environments, or settings where food can be obtained and/or consumed. (Story, Kaphingst, Robinson-O'Brien, & Glanz, 2008). Historically, a person's physical eating environment rarely extended outside of the home and a majority of daily calorie intake came from FAH. However, because of the American lifestyle, nearly a third of daily energy consumption is obtained outside of the home in physical eating environments such as schools, work-sites, and eating establishments (e.g., restaurants and fast-food chains) (Story et al., 2008).

A majority of away-from-home settings provide food and beverage choices that are very appealing to the American consumer – they are cost effective, processed, ED, convenient and available throughout the day (Cummins & Macintyre, 2005; Fox, Dodd, Wilson, & Gleason, 2009). Although it has been indicated that consuming less FAFH can improve overall diet quality, decrease energy density of diet and potentially reduce risk for obesity; there has been no indication that FAFH consumption is decreasing. As a result, many obesity prevention and nutrition policies and programs are targeting away-from-home eating environments in order to improve nutrition-related behaviors. These programs not only focus on influencing individual behavior but also the eating environment which individuals obtain and consume food.

Nutrition Labeling and Education Act (NLEA)

The first significant change made to improve consumer's nutrition awareness of food and beverage purchases was the NLEA, which took effect in 1994. The NLEA allowed the U.S. Food and Drug Administration (FDA) to regulate nutrition facts labeling and health claims. More specifically, the FDA 1) ensured health claims posted on food and beverages met agency standards; and 2) required a nutrition label on a majority of the foods and beverages the agency regulated (U.S. Food and Drug Administration, 1994). Nutrition labels were required to include accurate and specific information about the nutritional content of the food based on an established serving size, be clearly visible, and understood according to daily dietary needs. The NLEA significantly modified the nutrition label posted on foods and beverages, and also increased the number of items under FDA regulation requiring a nutrition facts label to near 100%.

The primary goal of the NLEA was to provide consumers with nutrition information to assist them with making informed food and beverage choices, and maintain healthy lifestyles (FDA, 1994). Numerous studies have been conducted to determine the effectiveness of the NLEA mandated nutrition labels, as well as factors relating to the use of nutrition labels on consumer's food choices. Overall, nutrition labeling is generally well understood and increases awareness about food and beverage nutritional content but is only influential on select consumers. Its level of effectiveness is often leveraged by other variables that factor into product purchase such as taste and price. In an article published using four different studies to evaluate the impact NLEA had on consumer's use of nutrition information, it was found that NLEA had little effect on consumers' search for and processing of nutrition information (Balasubramanian & Cole, 2002). The authors determined that NLEA increased consumer sensitivity to and choice based on select negative nutrients, such as fat and sodium, but not calories. They also found that NLEA was the most helpful to highly motivated, low-knowledge consumers, and that other factors besides nutrition information, still played a huge role in consumer's food choices. This was echoed in a systematic review of literature surrounding the use of nutrition labels, which found that 1) consumers primarily used nutrition labels and health claims on the front of the package to avoid use of certain negative attributes; 2) other factors, such as taste and price, on many occasions have a greater impact on food choice than nutrition information; and 3) overall, the use of nutrition labels can positively impact dietary intake for some individuals (Drichoutis, Lazaridis, & Nayga, 2006). Grunert, Wills, and Fernandez-Celemin (2010) found, based on observations, interviews and surveys conducted in selected UK grocery stores, that while 70-90% of participants possessed a good understanding of different nutrition labeling used on products, only 27% reported and were actually observed using labels.

Nutrition Labeling in Eating Establishments

One major drawback of the NLEA is that it only applies to food and beverage purchased for FAH. This soon became a concern as a greater percentage of food was being consumed away from home and obesity rates continued to escalate. Expanding the availability of nutrition information beyond the grocery store shelves became a focus for many public health agencies and obesity prevention initiatives. Initially, many restaurants and fast-food chains began voluntarily providing calorie information to their consumers. Also, a number of states passed

laws that required eating establishments with a certain number of locations to post calorie information (Center for Science in the Public Interest, 2008; New York City Department of Health and Mental Hygiene, 2007). Eventually, posting nutrition information in FAFH establishments became a federal mandate. In 2010, section 4206 of the Affordable Healthcare Act was passed, which requires all eating establishments and vending machine operators with more than 20 locations in the U.S. to disclose the nutrition information about their products to consumers (Unified Agenda of The Federal Register #0910-AG57, 2011). Posting nutrition information for eating establishments with less than 20 locations is voluntary.

Several studies have been conducted in both natural and laboratory setting to evaluate the influence posting nutrition information in FAFH eating environments have on consumer behavior and food consumption. While some credible studies found nutrition labeling having a positive influence on food choice and calorie intake, a majority have determined that labeling has little to no influence on food choice and calorie intake. Additionally, although a majority of participants in these studies desired to have nutrition information available, results indicated that only those possessing certain demographic characteristics (e.g., female) were most influenced by nutrition labeling (Roberto, Larsen, Agnew, Baik, & Brownell, 2010).

In 2010, a study was published to determine the influence restaurant menu nutrition labeling had on calorie intake. Over 300 adults were recruited and assigned to one of three menu conditions – a menu with no labeling, one with only calorie labels, or one that contained calorie labels as well as information regarding recommended calorie intake. Results indicated that the total calories ordered with the calorie label and calorie label plus nutrition information group were significantly less compared to the no label group; however, there was no statistical significance in calorie consumption among the three groups (Roberto et al., 2010).

Two studies that focused on fast food establishments found mandatory nutrition labeling had no influence on calories purchased. Finkelstein, Kiersten, Chan, and Krieger (2011) evaluated sales and transaction data of 25 randomly selected fast food chain locations prior to and at two periods following menu nutrition labeling. Some locations were required to post nutrition labeling while others were not. Results from their study indicated menu labeling had no influence on both overall sales transactions and calories purchased per occasion. This was echoed in an earlier study that evaluated the influence calorie labeling had on major fast food chains in New York City. Calories purchased prior to and one month after nutrition labels were

posted were compared and also compared to the same fast food chains located in Newark, New Jersey where no nutrition labeling was implemented. Results indicated that 57% participants stated noticing the labels and 88% of those that noticed indicated that they purchased fewer calories because of the labeling. However, the average number of calories purchased after labeling actually increased compared to the amount purchased prior to labeling (846 vs. 825). It was determined the labeling did not have any influence on calories purchased (Elbel, Kersh, Brescoll, & Dixon, 2009).

Lando and Labiner-Wolfe (2007) established eight focus groups, as part of the US Food and Drug Administration's (FDA) Obesity Working Group, to determine 1) consumer interest in having point-of-purchase (POP) nutrition information in restaurant and fast food establishments; and 2) the influence posting nutrition information had food choices. Results of the focus groups indicated that a majority of participants wanted to have nutrition information posted at eating establishments, but this information would not always be used to make product choices. Other influences such as taste, price, preference, convenience and desire for certain foods and/or beverages often mitigated likelihood of making a healthy food choice.

Other more recent studies have evaluated the influence calorie labeling when coupled with daily or per-meal calorie guidance had on calorie purchased and consumption. Morley et al. (2013) studied the influence five different menu formats had on food selection and found that of the information provided - calories, percent recommended daily calorie intakes, and simplified traffic lights - participants used the percent recommended daily calorie intake information the least. This was also found in another similar study, where food-purchasing behavior did not improve after the addition of calorie guideline information (Downs & Sandon, 2013). Both studies indicated that the complexity of the information made it difficult for participants to use and apply to their own diets.

Food Labeling Systems

As research has indicated, the effectiveness of calorie labeling and calorie related information is marginal at best. Consumer use of nutrition labels has also been limited because they can be confusing and lack information that helps consumers apply the information to their own diets. As a result, many eating establishments, especially worksite and university cafeterias, have developed specific food labeling systems that code products based on their nutrition

content. Instead of consumers trying to evaluate a nutrition label and decide whether the food is a healthy choice for them or meets the limits of their daily calorie needs, they can simply look for a specified label in order to make the healthiest choice.

Several studies have evaluated the effectiveness of these types of nutrition labeling programs, and similar to calorie labeling, these simplified nutrition-labeling programs have proven to be either ineffective or only marginally effective at influencing consumer food and beverage choices. A study published in 2011 evaluated the impact POP nutrition information had on the daily intake of diners in a university cafeteria. Participants' average daily calorie intake was evaluated before and after cafeteria meal options were labeled using the selected star-labeling system. It was concluded from the results that POP nutrition labeling did not influence participants' cafeteria meal choices or nutrient intakes (Hoefkens, Lachat, Kolsteren, Van Camp, & Verbeke, 2011).

Another recent study evaluated the influence nutrition labels had on sales of select items in a worksite cafeteria by comparing baseline and intervention facilities group sales data. It was found that there was no significant difference between the two groups and authors concluded that nutrition labels had little influence on the food choice of select meal items (Vyth et al., 2011). Feedman and Connors (2010) experienced similar results in their study that was conducted in a university convenience store. Healthier food and beverage items were labeled with a POP nutrition label, and sales data six weeks before and after the intervention was compared. Results indicated that there was no statistical significant difference in sales of labeled items before and after the intervention.

Changes to Foodservice Menu Standards

The primary goal of food and nutrition labeling programs is to help individual consumers make informed nutrition choices. However, as previous literature has revealed, most of these programs are overall ineffective at influencing individual eating habits and reducing overall obesity rates. In recent years, many organizations such as the World Health Organization, have determined that developing and implementing programs that target change in eating environments is more effective way for combating nutrition and obesity problems (World Health Organization, 2004). In a 2010 report published by the U.S. Department of Health and Human Services, the Surgeon General stated that not only should the focus of obesity prevention target

individual behaviors but also aspects of the social physical environments (U.S. Department of Health and Human Services, 2010). As a result, the focus of several nutrition intervention strategies has begun to shift from the individual to making changes to the eating environment in order to influence nutrition behaviors. Many of these new policies and programs have had a positive impact on the school eating environment, and have the potential to be carried over into other eating environments away from home.

In 2005, the Los Angeles Unified School District (LAUSD), the second largest school district in the country, implemented two different nutrition policies that restricted sales of unhealthy foods and beverages on their campuses. The goal of these two policies was to ensure that only nutritious foods and beverages were available to students within school environment (Los Angeles Unified School District, 2005). Approximately a year after the policies took effect, Vecchiarelli, Takayanagi, and Neumann (2006) conducted a study to evaluate the students' perceptions of the nutrition policies and if the policies had any impact on dietary behavior. Nearly 60% of students surveyed indicated that the Healthy Beverage Resolution policy impacted their beverages consumed at school and over 50% reported that the Obesity Prevention Motion policy influenced their snack choices at school.

Texas Public Schools implemented a similar nutrition policy, which focused not only on eliminating sales of non-nutritious vending and snack bar choices, but also on improving the nutrition quality of school menus (Texas Department of Agriculture, 2010). Studies conducted to determine the effects of this policy found that one year following implementation, students' 1) overall energy density of intake decreased significantly; 2) consumption of vegetables, milk, and essential nutrients increased; 3) intake of high-calorie, less-nutritious foods decreased; and 4) the percentage of total fat decreased (Cullen, Watson, & Zakeri, 2008; Mendoza, Watson, & Cullen, 2010).

In 2012, for the first time in over 15 years, significant changes were made to the National School Breakfast and Lunch Programs (NSBP & NSLP). Per the legislative mandate following the signing of the Healthy, Hunger-Free Kids Act of 2010, NSLP nutrition and menu standards are now required to be synonymous with the latest dietary guidelines for Americans (United States Department of Agriculture, 2012a). These changes increased the availability of fruit, vegetable and whole grain offerings, and established age-specific meal calorie and sodium limits (USDA, 2012b). Like other school nutrition policies, the goal of the new NSLP menu and

nutrition standards are to improve the nutrition quality of meals provided to children in the school environment.

U.S. Military Nutrition Intervention Strategies

Rising obesity rates among military populations, and the number of those potential, new and current service members struggling to meet weight and bodyfat standards have become the target of several military health policies and programs over the past several years. Initiatives have been developed to educate service members' about the importance of nutrition and to improve their dietary habits. Worksite eating environments, such as military dining facilities (DFACs), have been the primary avenues used to implement many of these strategies because they are utilized by thousands of service members on a daily basis (Bray et al., 2009). Many of these initiatives are similar to those implemented to improve dietary habits of the U.S. population, and aim to influence nutrition behaviors at both the individual and environmental level.

Calorie Labeling

Along with nutrition education materials, POP calorie labeling was introduced into Army DFACs over a decade ago. Using the nutrition information derived from standardized recipes, the nutrition facts label was posted for main items served each day in order to help service members make informed food choices. To date, only one study was published evaluating the influence POP calorie labeling had on service members' meal selections. Sproul, Canter, and Schmidt (2003) surveyed customers and also analyzed sales data of selected target entrees prior to and at two different time points after entrees were labeled. Survey results indicated that nearly two-thirds of participants surveyed stated they noticed the labels; of those that noticed the labels, only 20% indicated the labels influenced their entrée selections. It was determined from sales data that the nutrition labeling did not increase sales of targeted entrees.

Go for Green

In 2008, the Army began replacing POP calorie labeling with a simplified nutrition labeling system called the *Go for Green* program (Figure 2.1). *Go for Green* is a comprehensive food and beverage labeling system that provides service members with a quick and simple method of evaluating the nutrient content of menu items provided in Army DFACs (U.S. Army

Figure 2.1 *Go for Green* program criteria

Eat Often	Eat Occasionally	Eat Rarely
Entrees Single Items: <300 calories <10 g fat Full Dish: <500 calories <18 g fat	Entrees Single Items: 300-500 calories 10-15 g fat Full Dish: 500-700 calories 18-25 g fat	Entrees Single Items: >500 calories >15 g fat Full Dish: >700 calories >25 g fat
Starchy Side: <200 calories Higher fiber choices	Starchy Side: 200-300 calories	Starchy Side: >200 calories
Vegetable: <100 calories	Vegetable: <100 calories	Vegetable: >200 calories
Dessert: <150 calories <6 g fat	Dessert: 150-300 calories 6-12 g fat	Dessert: >300 calories >12 g fat
Beverage: Water, calorie-free/low calorie beverages, 100% fruit juice	Beverage: Sports drinks	Beverage: Fruit Juice (less than 100% juice), fruit drinks, energy drinks, Kool-aid [®] , regular soda
Dairy: Skim or 0-1% fat	Dairy: Reduced fat or 2% fat	Dairy: Whole or 4% fat

Note. Adapted from United States Army Quartermaster School Joint Culinary Center of Excellence (JCCoE). (2012). *Go for Green Program Criteria*. Retrieved from http://www.quartermaster.army.mil/jccoe/Operations_Directorate/QUAD/nutrition/Program_Criteria_g4g_Approved_Version_2013.pdf

Food Service, 2012). The nutrition education theme for the labeling system is soldier performance. Foods and beverages labeled red are considered high in calories, fat and/or sugar, and low in nutrients. Those labeled yellow are moderate in calories, fat and/or sugar, and nutrients. Green- labeled items are lower in calories and sugar, and less than 30% of calories are from fat. Additionally, a majority of green items are considered nutrient-dense. Service members are encouraged to choose more green items for optimal energy, health and physical performance.

In 2012, *Go for Green* was adopted as the standardized nutrition education program and by regulation, this program is required to be implemented in all DFACs (Headquarters Department of the Army, 2012). Currently, there are no published studies evaluating the impact food labeling has on service members' food choices; however, results from one unpublished study evaluating the effectiveness of the nutrition labeling system using a survey indicated that 96.7% of soldiers noticed the *Go for Green* labels. Of those soldiers that noticed the labels, 32% reported the labels significantly influenced their food choice (Reid & Jackson, 2011). Although more studies are needed to determine the overall effectiveness of this initiative, the program possesses the potential to assist with improving the overall military eating environment and encouraging soldiers to adopt healthier eating behaviors.

Initial Military Training Menu Standards

The intent of military POP calorie and food labeling programs was to assist the individual soldier with making informed food and beverage choices in military DFACs. However, as the number of unfit, overweight soldiers with poor nutrition habits entering the military continued to increase, further action was taken to provide a highly nutritious eating environment for this population of soldiers. In 2010, the Army developed and implemented the Soldier Fueling Initiative (SFI), a very robust nutrition initiative that significantly changed the menu standards of DFACs that serviced soldiers in their initial military training (IMT). The SFI established new fueling, or feeding, standards in order to 1) improve soldier readiness, fitness and performance; and 2) address the declined nutrition status and poor dietary habits observed in this particular military population (U.S. Army Food Program, 2012). The SFI is comprised of many different nutrition-related components, such as education and awareness; however, the primary tenant of the SFI is the IMT menu standards. The IMT menu standards are a significant modification to

the garrison menu standards, or the current menu standards implemented in Army DFACs (Headquarters Department of the Army, 2012). The IMT menu standards provide very specific menus and meal offerings, recipes, preparation methods and portion size guidance for DFACs to follow. These new standards ensure a majority of foods and beverages offered are lower in energy density and high in nutrient quality, and only minimal energy-dense, low-nutrient choices are available at each meal (U.S. Army Food Program, 2012).

Implementation of the IMT menu standards and its impact on IMT soldiers so far has been very successful. The program has received national recognition by first lady, Michelle Obama, and Army IMT leaders have experienced lower attrition rates among IMT soldiers since implementation of the new menu standards within basic training DFACs (Kappler, 2011). Currently, the IMT menu standards are only implemented in trainee Army DFACs, while all non-trainee Army DFACs continue to follow the garrison menu standards. Although garrison menu standards are designed to provide adequate nutrition for soldiers, the IMT menu standards maximize offerings of foods and beverages that are high in nutrients, promote better performance and encourage weight management. The IMT menu standards could certainly benefit all soldiers and because of its initial overall success, an opportunity exists to implement these menu standards Army-wide.

Currently, no studies have been published to examine the impact IMT menu standards have on soldier populations and until recently, there were no studies published examining the effectiveness of military DFAC menu standards. Crombie et al. (2013) examined the effects of slight modifications to current garrison menu standards on the nutrient intake of non-training soldiers eating in non-trainee Army DFACs. Modifications made for this study ensured menu standards were in compliance with the 2005 Dietary Guidelines for Americans. Nutrient intakes, food selection and overall satisfaction were measured in both control and intervention DFACs and then compared. Results were promising in regards to nutrient intake and customer satisfaction, but not food selection. Although still above recommended intakes, participants' calories, percent calories from fat and saturated fat all decreased and customer satisfaction increased following the menu changes. Also, while greater amounts of fruits, vegetables and whole grains were available, selection and consumption of these items did not increase and often times because they were still available, patrons continued to choose the less healthy options.

Factors Influencing Food Choices

Eating a healthy diet and making nutritious food choices is a key strategy to effective weight management and obesity prevention (The American Dietetic Association, 2009). Eating healthy on a regular basis ensures adequate intakes of nutrients, and energy is consumed in order to sustain health and support daily activity. Adhering to a healthy diet is important throughout the life cycle and a majority of daily food choices should be those that support eating a healthful lifestyle.

Through education and marketing, many Americans are aware of the importance and benefits of making nutritious food choices; however, often, individual food choices are heavily influenced by individual, situational and/or environmental factors, especially when it comes to FAFH food choices. Several published studies have evaluated the influence different variables have on individual food choice, what variables influence health food choice and also what barriers exist that deter individuals from making healthy food choices. Glanz and colleagues (1998) conducted a study that evaluated the relationship between certain demographic variables, overall lifestyle and importance of certain food choice attributes. Over 2,900 adults across the U.S. first completed a lifestyles survey followed by a health-styles survey. Results from the surveys indicated that taste ranked highest among all demographic characteristics. Nutrition ranked high among females, the elderly and those considered having the “healthiest” lifestyles. Weight management also ranked the highest among those with the healthiest lifestyles. Price was most important among younger individuals. When evaluating influences on food choice given a specific environmental condition (e.g., FAH versus FAFH), it was found that nutrition and weight management ranked of lowest importance when making fast food choices, while convenience ranked the highest (Glanz, Basil, Maibach, Goldber, and Snyder, 1998). French (2003), in a symposium paper, summarized the effects of pricing on healthy food choice. Two different price reduction strategies involved lowering the cost of healthy food items in vending machines and school cafeterias. Results from both of these studies found that when prices were lowered on healthy food items, sales of these items significantly increased (French, 2003). These data clearly indicate the overwhelming influences of price on food choice. However, the higher costs associated with many healthy foods than processed, less healthy food choices certainly present a barrier to eating healthy for many.

Nutrition knowledge has also been evaluated to determine if greater nutrition knowledge results in healthier food choices, and if lack of nutrition knowledge is a barrier to healthy eating. A study published in 2007 evaluated the influence nutrition knowledge had on college-aged students' likelihood of making healthy food choices. Results from the survey administered to 200 college students indicated that overall, students with greater nutrition knowledge made healthier food choices (Kolodinsky, Harvey-Berino, Berlin, Johnson, & Reynolds, 2007). Drichoutis and Lazaridis (2004) reported similar results in their study evaluating nutrition knowledge and use of food labels. They found that respondents with greater nutrition knowledge were more likely to use food labels and make healthier food choices, especially with regards to choices concerning fat, ingredients, and vitamins/minerals content.

Individual health concerns and attitudes toward healthy eating have also been addressed as factors that influence food choice. A study evaluating the relationships between health concern, food choice motives and attitudes found that individuals with greater concern for developing diseases placed greater emphasis on health-related food motives, resulting in more positive attitudes toward healthy eating (Sun, 2008). Several studies have also shown differences in attitudes toward healthy eating and food choice between genders. Levi, Chan, and Pence (2006) surveyed male and female college-aged students and found that almost 50% of females and only 27% of males surveyed were highly involved in their food choices and made ones that endorsed a healthy lifestyle. Also, in regards to factors that influence food decisions, females rated healthiness and label information significantly higher than did males. In a study conducted to determine if gender differences existed food choice based on health beliefs and dieting, both males and females at universities in 23 countries were surveyed about four different food choice behaviors and health beliefs. Results revealed that collectively, the importance of each food choice behavior and belief about each behavior was rated significantly higher among women compared to men. When each country was evaluated separately, the result was the same in almost every country being surveyed (Wardle et al., 2004).

Because food choice behavior can be influenced by many variables, several different models, as well as modified versions standard models, have been used to predict the likelihood of making healthy food choices. One model that has been frequently used to predict beliefs about healthy eating and eating a quality diet is the health belief model (HBM). The HBM is flexible and does not specifically define how variables included in the model predict the outcome

(Nejad, Wertheim, & Greenwood, 2005). Studies using the HBM to measure diet quality/healthy food behaviors have interpreted the model differently and have added or removed variables based on the purpose of the study and/or the outcome(s) being measured. In the context of measuring beliefs about health or diet quality (outcome), Sapp and Jensen (1998) and Sapp and Weng (2007) postured that eating a quality diet or possessing strong nutrition food beliefs is influenced by several variables including 1) benefits and barriers related to eating a quality diet, 2) overall importance of eating a quality diet, 3) perceptions about current diet quality, 4) readiness to take action, 5) sociodemographic, situational and environmental conditions, and 6) awareness of diet-health relationships (Sapp & Jensen, 1998; Sapp & Weng, 2007). Other studies have included additional variables such as food features, self-efficacy, and intentions to predict health-related behaviors as relevant factors influencing individuals' food choice and consumption behaviors (Deshpande, Basil, & Basil, 2009; Nejad, Wertheim, & Greenwood, 2005).

Sapp & Jensen (1998) and Sapp & Weng (2007) both interpreted the model in such a way that eating a quality diet was influenced by perceived benefits, barriers, and importance of eating a quality diet. The importance of eating a quality diet was influenced by perceptions of current diet and awareness of diet-health relationships. Cues to action from others, as well as certain modifying factors such as sociodemographic, situational and environmental conditions also influenced perceived importance of eating a quality diet.

Both studies elaborated on each of the variables used in the model. Benefits and barriers are used to measure the probability of positive and negative consequences associated with the outcome, and the importance of the outcome measures perceptions about much the outcome is valued. Cues to action determine if the perceived importance of the outcome was influenced by significant others, media or a professional. Sociodemographic information is any sociodemographic variable, such as age or gender, which may have an influence on other variables in the model. A situational variable is an external influence on behavior. A common situation variable used in the HBM measuring dietary quality is nutrition knowledge. Environmental conditions are variables that indirectly influence the outcome. Variables commonly measured for this particular outcome include price, taste and convenience. Awareness of diet-health relationships measures to what extent the understanding of the

relationship has on the perceived importance of the outcome (Sapp & Jensen, 1998; Sapp & Weng, 2007).

When compared to other similar models, the HBM has been shown to effectively predict diet-related behaviors (Nejad, Wertheim, & Greenwood, 2005). Sapp and Jensen (1998) used survey results from the 1991 CSFII to demonstrate the ability of the HBM to predict perceived diet quality based model variables evaluated, but not on dietary quality based on nutritious food behavior. Sapp and Weng (2007) surveyed over 1,300 adults nationwide to determine if the HBM was a good predictor of eating a quality diet and BMI. The results indicated that the HBM was able to moderately predict diet quality and BMI, but that not all variables including nutrition knowledge were good predictors for diet quality. A study conducted in 2009 used the HBM to determine what factors influenced the healthy eating habits of college students. It was found that overall, the HBM was useful in predicting college students' dietary practices (Deshpande et al., 2009).

Customer Satisfaction and Return Intentions

One of the most common measures extensively studied and used to determine repurchase intentions for foodservice establishments is customer satisfaction. It has been found that the positive impact resulting from customer satisfaction can be very beneficial to organizations, and leads to loyalty and positive word-of-mouth communication. Kim, Yee Nee Ng, and Kim (2008) published a study evaluating the impact customer satisfaction had on return intentions and positive word-of-mouth communication in college dining facilities. After surveying 770 undergraduate, graduate and full-time employees at a Midwestern university, it was determined that customer satisfaction was highly correlated with both return intentions and positive word-of-mouth communication (Kim et al., 2008). This was echoed in a study conducted among quick-casual restaurants in which the relationship between restaurant image, perceived value, customer satisfaction and behavior intentions was evaluated. Results indicated that not only was customer satisfaction a strong indicator of behavior intentions (defined as likelihood to return and positive word-of-mouth communication) but also served as a mediator between restaurant image and perceived value, and behavior intentions (Ryu, Han, & Kim, 2007).

As opposed to customer satisfaction, dissatisfied customers complain, exercise negative word-of-mouth communication, and are less likely to return. Zeelenberg and Peters (2002)

published a study evaluating the behavioral responses associated with customer dissatisfaction, which was expressed in the form of regret and/or disappointment. Participants expressing dissatisfaction in the form of regret were likely to switch to another service provider, while those experiencing dissatisfaction in the form of disappointment were likely to complain, provide negative word-of-mouth communication and also seek similar services elsewhere.

Customer satisfaction within the foodservice industry can be influenced by many factors, however; those found to be common to the food service industry are food quality, perceived value, and service quality. Among restaurants, Andaleeb and Conway (2006) evaluated the influence service quality, product quality, price, and food quality had on customer satisfaction. Service quality had the strongest influence on customer satisfaction, followed by food quality and price. Product quality failed to significantly influenced customer satisfaction. Qin and Prybutok (2009) experienced similar results in their study evaluating the influence the dimensions of service quality (SERVQUAL), food quality and perceived value had on customer service. It was determined from their results that four of the five SERVQUAL dimensions, along with recovery, significantly influenced customer satisfaction. Food quality, but not perceived value was also significant. This is also similar for institutionalized food service establishments, such as university cafeterias. Kim et al., (2008) found that food quality, atmosphere, service quality, convenience, and price/value were all significant variables influencing customer satisfaction in university dining facilities. Dollah, Mansor, and Mohamad (2012) determined that food quality, price and value of food provided were most common determinants of participants' overall satisfaction, and that there was a positive relationship between service quality and customer satisfaction.

Very few studies have been conducted to determine the influence healthy menu options have on customer satisfaction. One previously mentioned study addressed healthy menu options as a component of service quality, which was found to strongly influence customer satisfaction, but did not evaluate healthy menu options specifically (Kim et al., 2008). Crombie et al. (2013) found that customer satisfaction levels were higher in military dining facilities that offered a greater number of healthy menu options. Another study evaluated the effects a healthy options only worksite canteen had on customer satisfaction. Results indicated that customers were satisfied with the healthful options canteen and were overall more satisfied with the worksite

cafeteria after the addition of the canteen. Addition of the canteen also improved the cafeterias financial performance of cafeteria (Kimathi, Gregoire, Dowling, & Stone, 2009).

Assessment of Food Intake

Accurately assessing a participant's food intake in a natural setting, such as a cafeteria, can be difficult, complex and very time consuming. Unlike laboratory settings, food selections and amounts, as well as food intakes are recorded as it is occurring and methods used must accurately account for the variance that exists from participant to participant. Over the past several years, different methods have been developed and successfully used in a multitude of studies where data collection occurred in natural settings, such as cafeterias.

Two common methods that have been used for several years to accurately capture food intake in natural setting are weighing and direct observation estimation methods. Direct observation methods involve trained individuals directly observing and recording participant selections, amounts taken, and food waste then estimating consumption based on what was observed (Baranowski & Simon-Morton, 1991). Weighing food selections and plate waste is considered the most accurate method to determine food consumption. This particular method involves weighing food items after selection and before consumption, and then again after consumption but before food leftovers are discarded. Differences between the two weights are then calculated to determine food consumption (Kirks & Wolff, 1985).

In 2003, another method of estimating food consumption called digital photography methods was developed using digital photography to estimate food consumption. These methods use techniques similar to observation methods except that digital photographs capture food selection and amounts, and plate waste. Before and after consumption photographs are matched, then carefully analyzed later on in a laboratory setting, and consumption of a food portion is estimated using 10% increments (Williamson et al., 2003). Dr. Williamson, the author of the original digital photography research, revealed that pilot studies conducted by the researchers determined that 10% increments was the smallest increment that would yield the most reliable results (personal communication, September 17, 2012).

All methods have been shown to be accurate and reliable when used in natural settings, and possess both advantages and disadvantages. Weighing has been found to be the most accurate method to determine food consumption when compared to other methods; however,

especially in natural settings, is very obtrusive and disruptive to food service operations and participants' meal period (Adams, Pelletier, Zive, & Sallis, 2005; Kirks & Wolff, 1985). Visual observation, although shown to be highly correlated with weighing methods and is less obtrusive, typically requires intense training and may also influence participants' food selections if not executed properly (Ball, Benjamin, Ward, 2007; Gittelsohn, Pakhrel, Shankar, & West, 1994; Williamson et al., 2003). Digital photography methods have been compared to weighing and visual observation methods in a laboratory setting, and was shown to be highly correlated with weighing; however, visual observation was more closely correlated than digital photography methods, 0.97 and 0.89, respectively (Williamson et al., 2003). When comparing the use of digital photography methods to visual observation in natural settings (e.g., cafeteria), it was found that estimates in four of the six food categories were comparable and that variability between the two methods was similar (Williamson et al., 2004).

Estimation methods have also been used simultaneously to estimate food consumption. Templeton, Marlette, and Panemangalore (2005) utilized both digital photography and weighing methods to accurately estimate energy and nutrient consumption of adolescents in a school cafeteria. Their study demonstrated that combining the methods not only provided highly accurate estimations, collecting data was also less obtrusive.

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Chapter 3 - Methodology

Introduction

The purpose of this study was to assess non-training soldiers' food choices and consumption and their satisfaction with current and initial military training (IMT) menu standards. The methodology for this research was two-fold: assessment of food selection and consumption, and customer surveys before and three weeks after implementation of IMT menu standards, which are healthier than current menu standards. Figure 3.1 describes the overall methodology used for this research. In the following sections, the study setting, participants, and detailed methodology used for this research are discussed. More specific content of this chapter includes data collection, location, and study participants; and step-by-step procedures used for preliminary investigation of current practices, assessment of soldiers' food selection and consumption, and assessment of soldiers' perception of their health status and meal satisfaction. Prior to data collection, use of human subjects was approved by Institutional Review Boards of Kansas State University (Appendix A) and Madigan Army Medical Center (Appendix B).

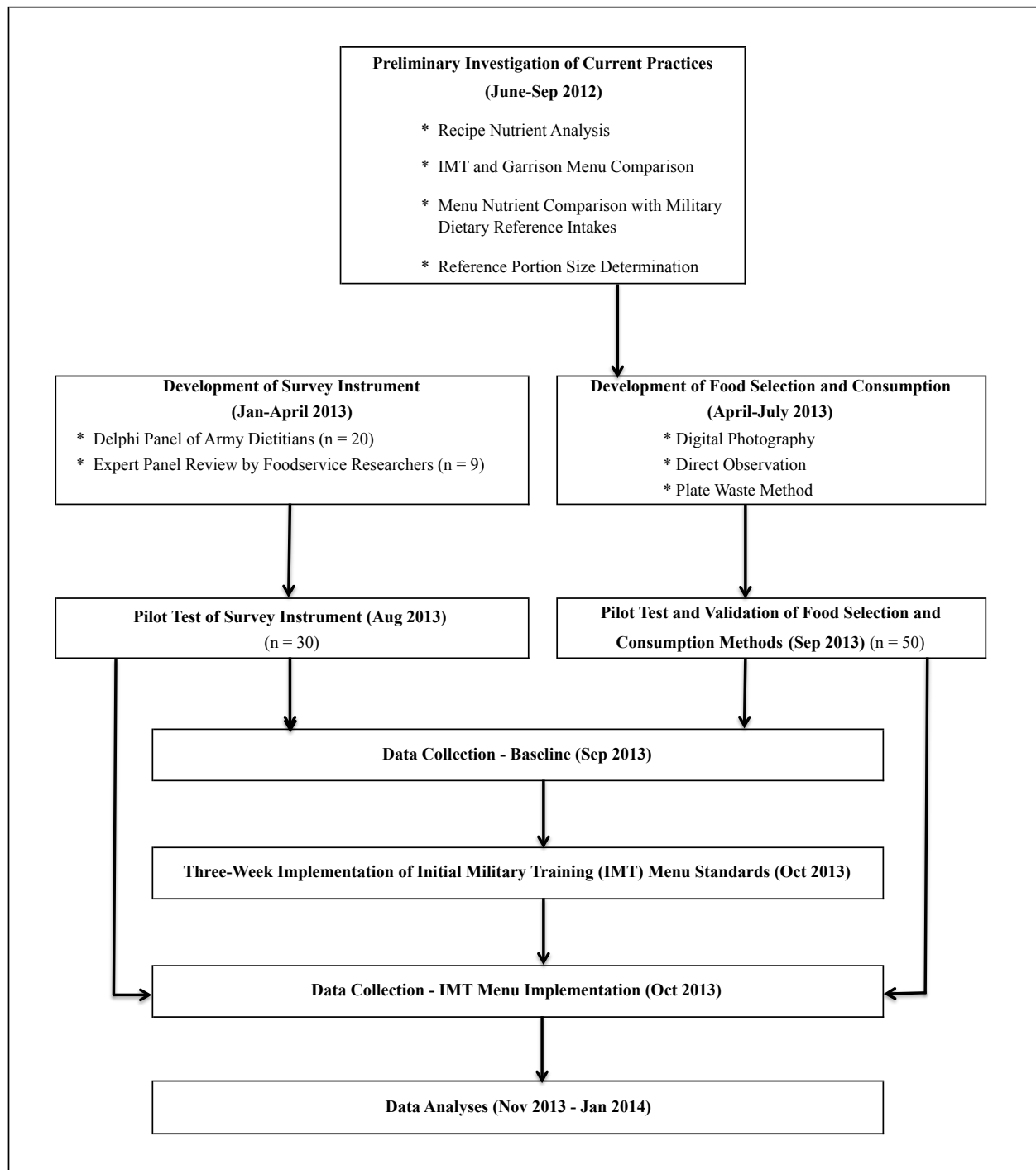
Data Collection Location and Study Participants

The population of interest for this study is United States (U.S.) Army soldiers in a non-training status who dine regularly at non-trainee dining facilities (DFACs). Fort Riley, Kansas was chosen as the location for the study because it is considered a Forces Command (FORSCOM) installation and a majority of its troop population consists of non-training soldiers from all areas of the United States. Therefore, its population was considered a representative sample of the Army's non-training soldier population.

There were four available DFACs and of those, Devil's Den DFAC was selected as the site for data collection for several reasons. First, Devil's Den is one of the larger DFACs on Fort Riley, and weekday lunch headcount ranges from 400-700 diners. Second, the installation food service advisor identified Devil's Den as an ideal location for the study, and lastly, the management staff located there was very interested in participating in the proposed research.

Devil's Den DFAC is open five days per week and every other weekend for breakfast, lunch and dinner meal service. Meal periods are 90 minutes in length and diners have the option to eat in the facility or take the meals to go. Customers are considered either cash paying

Figure 3.1 Overview of methodology



customer or a meal card holder. Cash paying customers include all civilians and soldiers not authorized a government furnished meal card. Meal card holders are soldiers eligible to receive an authorized amount of subsistence free of charge in Department of Defense (DoD) DFACs, and generally include those soldiers or other military service members who reside in the barracks, activated reservists, or soldiers in a training status.

Weekday lunch was chosen for recruitment and data collection because it is generally the largest meal served at Devil's Den, with daily headcounts ranging 400-700 diners. Soldiers dining in at Devil's Den during the lunch meal on one of the data collection days were eligible to participate in the study, while soldiers who chose to take their lunch meals to-go and diners who are not soldiers (e.g., Department of the Army civilian employees, family members, contractors, DFAC employees, etc.) were not eligible.

Preliminary Investigation of Current Practices

Four different important preliminary investigations were conducted in order to develop the research methodology. Each preliminary investigation is explained in the following section.

Recipe Nutrient Analysis

Nutritional information published on the Armed Forces standardized recipe is calculated per serving and includes seven nutrients – total calories, fat (g), carbohydrates (g), protein (g), cholesterol (mg), sodium (mg) and calcium (mg). For this study, additional nutrient information was sought including saturated fat, dietary fiber, iron, and vitamins A and C. These additional nutrients were chosen for analysis because it was determined that the nutrients currently published on the standardized recipe cards are too limited for this study. Inclusion of additional nutrients that are associated with weight management and general health (Academy of Nutrition and Dietetics, 2012; American Dietetic Association [ADA], 2007, 2008), and those currently analyzed by other food programs, such as the National School Lunch Program (U.S. Department of Agriculture [USDA], 2012), would provide a better understanding of the relationship between food consumption and attitudes toward health, as well as expand on the nutrient differences between the garrison and IMT menus.

A sample of seven lunch menus was selected from both the garrison and IMT menu. All standardized recipes used for each meal were printed off and organized by menu day. Menu items were assumed to be prepared from scratch unless stated otherwise by the DFAC production

manager. If a product was not made from scratch, the appropriate recipe from the recipe database was used for analysis, and if available, the food product description was obtained and used for analysis.

Each recipe ingredient was analyzed using the USDA National Nutrient Database for Standard Reference, version SR26 (<http://ndb.nal.usda.gov>), the same database which military professional personnel use as standard reference for menu analysis and nutrient consumption (Headquarters Department of the Army, Navy, and Air Force, 2001). The most recent version of the database, SR26, was released in August 2013 and contains data on 150 food components and 8,463 food items (USDA Agricultural Research Service, 2013). To verify calculated nutrient analyses were accurate, the nutrient analysis results were compared with published nutrient analyses by the U.S. Army. Results showed there were no significant differences between the two sources, hence nutrient analyses using USDA were used for this study.

In order to determine nutrients per serving for each recipe, nutrient totals were determined by summing the nutrients for each ingredient then dividing by 100 (each recipe yields 100 servings) and rounded to the nearest whole number. To verify the accuracy of data entry, the percentage of protein, carbohydrate (less dietary fiber) and fat calories for each recipe ingredient were calculated and compared to the total calories calculated for each recipe. The analyses were considered acceptable when the sum of kcals was within 95% to 105% of total calories. Any errors in data input were corrected as appropriate.

A paired samples t-test was conducted to compare the USDA nutrient analysis results for each recipe with the nutrient analysis printed on each recipe card. Nutrient comparisons were restricted to those nutrients printed on the recipe card and was assumed that there would be no significant difference between the additional five nutrients not analyzed if there was no significant difference between the seven nutrients analyzed (Table 3.1).

Results from the paired samples t-test indicated there were no significant differences between nutrients from two sources except for total kilocalories. On average, results from using the USDA National Nutrient Database estimated total kilocalories for entrée, side item, soup and salad, and dessert recipes were 3.5%, 8.7%, 8.8%, and 1.8% lower, respectively, than the total kilocalories printed on the Armed Forces standardized recipe. This underestimation was explained by the exclusion of dietary fiber from total carbohydrates in the Armed Forces standardized recipes, resulting in overestimation of total calories.

In conclusion, the nutrient analysis method using the USDA National Nutrient Database, Version SR26, was an accurate and reliable method of assessing the nutrient composition of menu items. The USDA database was used throughout the study to analyze all menu items from both the garrison and IMT menu standards in order to determine participant's nutrient consumption.

Table 3.1 Comparison of nutrient analysis methods using IMT and garrison lunch menus

Nutrient	Nutrient Analysis Method Means \pm SD ^{a, b}		<i>p</i>
	USDA	DoD	
Kilocalories	213 \pm 127	220 \pm 128	<.001
Carbohydrates	23 \pm 15	24 \pm 15	.120
Protein	13 \pm 12	13 \pm 12	.318
Total Fat	8 \pm 7	9 \pm 7	.245
Cholesterol	35 \pm 41	35 \pm 40	.568
Sodium	492 \pm 382	498 \pm 378	.683

Note. DoD = Department of Defense.

^a Rounded to the nearest whole number.

^b n = 177.

Nutrient Analysis and Comparison Between Two Menu Systems

Because no unexplained significant differences existed between results from the USDA nutrient analysis results and the information printed on the DoD's standardized recipe cards, the USDA nutrient analysis method was used to further investigate nutrient differences between the garrison and IMT menus and to compare planned menu analyses under garrison and IMT menu standards with the military dietary reference intakes (MDRIs). While it is assumed that nutrient differences between the garrison and IMT menus exist, currently there was no published data that support these assumptions.

The same two sets of seven-day lunch menus selected for developing the nutrient analysis methods were used for comparing nutrient contents. While a weighted average would have been more accurate for determining the nutrient content of a typical lunch meal served to soldiers

based on soldiers' choices, no historical data were available that could provide insight as to which menu items were chosen more often. Therefore, a straight average method was used to determine the nutrient content for a typical lunch menu with an assumption that each menu option had an equal chance of being selected.

Authorizations for a lunch meal include one entrée, any combination of three sides (starch, vegetable, soup, salad, or bread), and one dessert (The Army Food Program, 2012). All nutrients of interest as well as the percentage of total fat, saturated fat, carbohydrate and protein calories for each meal were then summed. An independent samples t-test was used to compare the meal straight average totals of the two seven-day lunch menu samples. Results are shown in table 3.2.

Results from the independent samples t-test indicated there were significant differences in total calories, carbohydrates, protein, fat, cholesterol, sodium, saturated fat, and the percentage of total calories from fat, saturated fat, carbohydrates and protein between the seven-day cycle menus under two menu standards. Total calories, fat, cholesterol and sodium were all significantly lower in the IMT menu compared to the garrison menu. Mean total dietary fiber, iron, and vitamins A and C were not significantly higher for the IMT menu cycle. The mean percentage of total calories from fat was $29 \pm 2\%$ in the IMT menu and $39 \pm 2\%$ in the garrison DFAC menu; mean percentage of total calories from saturated fat was 10% and 13%, and mean percentage of calories from carbohydrates were 58% and 49%, respectively. The significant differences can be attributed to the greater amount of plant-based menu choices found on the IMT menu.

In conclusion, because significant differences in nutrient contents were observed between the garrison and IMT menus to each other and also to the established MDRI, it is anticipated that significant differences in nutrient consumption will be observed when changing the menu system from the garrison to the IMT menu.

Menu Nutrient Comparison with MDRI

Army Regulation (AR) 40-25, *Nutrition Standards and Education*, establishes the military dietary reference intakes (MDRI), which are defined as specific nutritional standards developed for professional personnel involved in military menu development and evaluation, as well as military food research and development.

Table 3.2 Comparison of sample lunch menus' nutrient composition using straight average method

Nutrient	Menu nutrient Means \pm SD ^a		<i>p</i>
	IMT	Garrison	
Calories	842 \pm 29	1114 \pm 91	<.001
Carbohydrates (g)	122 \pm 9	137 \pm 8	.008
Protein (g)	38 \pm 1	44 \pm 3	.001
Total Fat (g)	27 \pm 3	48 \pm 6	<.001
Cholesterol (mg)	94 \pm 5	127 \pm 3	<.001
Sodium (mg)	1683 \pm 174	2367 \pm 151	<.001
Fiber (g)	12 \pm 4	13 \pm 1	<i>n.s.</i>
Iron (mg)	8 \pm 3	11 \pm 5	<i>n.s.</i>
Vitamin A (mg)	9597 \pm 7051	3193 \pm 1784	<i>n.s.</i>
Vitamin C (mg)	60 \pm 31	39 \pm 8	<i>n.s.</i>
Saturated Fat (g)	9 \pm 1	16 \pm 2	<.001
% Calories from			
Total Fat	29 \pm 2	39 \pm 2	<.001
Saturated Fat	10 \pm 1	13 \pm 1	<.001
Carbohydrate	58 \pm 4	49 \pm 2	<.001
Protein	18 \pm 1	15 \pm 1	<.001

Note. IMT = initial military training.

n.s. = not significant.

^aRounded to the nearest whole number.

These nutritional standards are based on the Food and Nutrition Board's Dietary Reference Intakes (DRI), and are applicable to hospital and garrison food service programs, as well as the DoD Combat Feeding Program. All food service operations are required to comply with the established MDRI (Headquarters Department of the Army, 2001).

Additional nutrient requirements have also been established as part of the MDRI that are incorporated into menu planning. Roughly 50-55% of total daily calories consumed should be

from carbohydrate sources, no more than 30% total calories should be from total fat and no more than 10% from saturated fat, and total cholesterol should not exceed more than 300 mg/day.

Table 3.3 displays selected MDRI's for both men and women.

Results from the independent samples t-test comparing average lunch menu nutrient composition were used to compare each menu to the established MDRI's in order to determine if either menu met established nutrient guidelines. When comparing the two menu results to the MDRI's, established intakes for men and women over the age of 18 were used. It was assumed, based on military nutrition standards guidance, that lunch menus are designed to meet 33% of the daily nutrient requirements for both men and women. Any caloric beverages offered during the lunch meal (e.g., milk, soda, juice) were not included in the analysis due to the complexity of estimating the amount and types of beverages without slowing down the DFAC lunch operation. Due to the limited time for the data collection and dining room characteristics, which allows soldiers to have unlimited amount of beverages with refills, beverage selection and consumption were not included in the data collection protocol.

Results from table 3.4 indicate that the IMT menu provides adequate calories for women but not for men while the garrison menu meets calorie needs for men but significantly exceeds the amount needed for women. The IMT menu meets dietary fat, saturated fat and cholesterol recommendations while the garrison menu exceeds it by 9%, 3% and 27%, respectively. Both menus exceed the protein and sodium recommendations for both genders. Based on these results, it was anticipated that participants' nutrient consumption from the IMT menu would more closely mirror the established MDRI's compared to meals served under the garrison menu standards.

Table 3.3 Selected MDRI for men and women

Nutrient	Unit	Women	Men	33% MDRI ^d	
				Women	Men
Energy ^b :					
<i>General/Routine</i>	kcal/day	2300	3200	759	1056
<i>Light Activity</i>	kcal/day	2200	3000	726	990
<i>Moderate</i>	kcal/day	2300	3250	759	1073
Activity					
<i>Heavy activity</i>	kcal/day	2700	3950	891	1304
<i>Exceptionally</i>					
<i>heavy activity</i>	kcal/day	4600	3150	1040	1518
Protein ^c	g/day	72	91	24	30
Vitamin A	IU/day	8000	10000	290	330
Vitamin C	mg/day	75	90	25	30
Iron	mg/day	15	10	5	3.3
Sodium	mg/day	3600	5000	1180	1650

Note. MDRI = military dietary reference intakes.

Adapted from AR 40-25, "Nutrition Standards and Education," by Headquarters, Department of the Army, Navy, and Air Force, 15 June 2001, pp. 5-6. Copyright 2001 by Headquarters Department of the Army, Navy, and Air Force. Each value was rounded to the nearest whole number. MDRI = military dietary reference intakes.

^aValues for energy, protein, and associated nutrients are expressed as an average daily nutrient intakes and based on moderate activity levels and reference body weight of 79 kg (174 lb) for military men and 62 kg (136 lb) for military women.

^bEnergy Recommendations for various activity levels are estimates only and vary among individuals. The general values are for moderate levels of activity and are appropriate for most personnel in garrison. Values are rounded up to the nearest 50 kcal.

^cThe initial values in the table represent the midpoints of the ranges calculated using military reference body weights and protein intake recommendations of 0.8 to 1.5 g per kg body weight.

^dCalculated by multiplying the MDRI by 33%.

Table 3.4 Comparison of nutrient contents of the menu planned using IMT and garrison menu standards with established MDRI

Nutrient	Menu nutrient contents		33% MDRI	
	IMT Menu	Garrison Menu	Women	Men
Calories	842	1114	759	1056
Carbohydrates (g)	122	137	n.e.	n.e.
Protein (g)	38	44	24	30
Total Fat (g)	27	48	n.e.	n.e.
Cholesterol (mg)	94	127	≤100	≤100
Sodium (mg)	1683	2367	1188	1650
Fiber (g)	12	13	n.e.	n.e.
Iron (mg)	8	11	5	3.3
Vitamin A (IU)	9597	3193	2667	3333
Vitamin C (mg)	60	39	25	30
Saturated Fat (g)	9	16	n.e.	n.e.
% Calories from ^a				
<i>Total Fat</i>	29	39	≤30	≤30
<i>Saturated Fat</i>	10	13	≤10	≤10
<i>Carbohydrate</i>	53	49	50-55	50-55
<i>Protein</i>	18	15	10-15	10-15

Note. MDRI = Military Dietary Reference Intakes.

n.e. = not established.

^a Calculated as a daily percentage.

Reference Portion Size Determination

A preliminary requirement for developing the digital photography methods was to establish the reference portion size - the typical portion of food served to each customer. Determining the reference portion size is critical for accurate assessment of food consumption and nutrient intake. Although the recommended portion size that should be given to each customer is annotated on the standardized recipe, it is unknown if the actual portion sizes of food served are consistent with the standardized recipes. Because of the potential variability of serving sizes within institutional food service settings, it was not to be assumed that the

recommended portion sizes were consistent throughout the study. If significant variability does exist between portion sizes given by DFAC staff, it will not be feasible to accurately assess nutrient intakes using the suggested serving sizes.

In order to determine accuracy and consistency of served portions, portion sizes of randomly selected menu items served by employees in the DFAC were measured and analyzed. Descriptive statistics for each selected menu item sample were used to determine variability and means were compared to the recipe suggested serving size.

A three-week production schedule was obtained from the DFAC management. Menu items served to customers were carefully selected and included a variety of food shapes and consistencies. A total of 12 main entrees, sides, and short order items were selected for analysis.

Portions of selected food items were randomly weighed over a two-week period (excluding weekends) during lunch service. A flat, solid surface behind the serving line and near the selected menu item was designated for placement of an 11-pound capacity digital food scale.

Food portions were served on either an 8-inch plate or in a large to-go tray with a lid. A random sample of 20 plates and to-go trays were selected and individually weighed. Average weights for both the plate and to-go tray were determined and subtracted from the total weights when appropriate.

For each selected menu item, portions of food were weighed in grams approximately every two minutes until a sample size of at least 30 weighed portions was collected. Portions of food were weighed after they were placed on the plate and before given to the customer. If the plate or to-go tray was not empty, then the plate or to-go tray would first be weighed and tared before the portion of the selected food item was placed on the plate or to-go tray.

The total weight shown on the digital scale for each plate or to-go tray was annotated on a record sheet created specifically for recording the weight of selected menu items. Once the weight of each portion size was determined, it was transcribed into an excel worksheet for statistical analysis.

At least 30 samples were weighed for eight of the twelve selected foods. Time constraints for lunch service, the amount of food item prepared and popularity of the food item influenced the total number of samples collected for each food item. All selected foods were analyzed regardless of sample size. Table 3.5 provides the descriptive statistics and suggested serving size for each menu item.

Results indicate that food items' variance ranged from 10 to 53%. Mean weights were 48-126% the suggested serving size weights.

Table 3.5 Consistency and accuracy of selected food items served

Menu Item	n	S.S.S. (gm)	Mean (SD)	Percent S.S.S. ^a
Broccoli Cheese Rice Casserole	31	193	127 (26)	66%
Braised Beef Cubes	30	135	135 (18)	100%
French Fries	31	99	107 (19)	108%
Spinach Lasagna	31	384	278 (53)	72%
Pulled Pork Sandwich	26	149	160 (28)	107%
Roast Pork	30	99	117 (28)	118%
Southern Fried Catfish	31	113	102 (19)	90%
Scalloped Potatoes	30	128	122 (20)	95%
Islander Rice	14	101	115 (10)	114%
Tangy Spinach	8	90	113 (13)	126%
Mexican Corn	25	148	77(12)	52%
Pork Fried Rice	31	180	86 (15)	48%

Note. All weights are in grams and rounded to the nearest whole number.

S.S.S. = suggested serving size.

^aThe percent S.S.S. is based on the mean weights of selected menu items.

Based on these results, it was concluded that significant variance existed among portion sizes served, and sample mean weights were not consistent with the suggested serving size. Therefore, suggested serving size annotated on the recipe were not to be used as the reference portion size; instead, the reference portion size were defined as the mean weight of a sample of food portions served to customers on data collection days. Also, because variability among food portion sizes often exceeds 10%, using 10% increments to estimate food selection and consumption for original digital photography methods were questioned. Due to difficulty in estimating plate wastes visually, participants' leftover food on plates were to be weighed and subtracted from the reference portion size.

Intervention and Data Collection for Food Selection and Consumption

Overview

Data collection for both the garrison and IMT menu was conducted over an eight-week period, which consisted of a three-week baseline period, a two-week transition period, and a three-week implementation period. Food selection and consumption assessment, and survey administration occurred during the lunch period on one weekday for each menu cycle.

During the baseline period, all meals were prepared according to the garrison menu standards, and data were collected on a day when the DFAC census was projected to be high. During the implementation period, a standardized three-week IMT menu was implemented and all lunch and dinner meals were prepared using the IMT menu standards. To allow diners repetitive exposure to the IMT menu, data was not collected until the final week of the three-week implementation period, when food selections were modified to ensure compliance with IMT menu standards and beverage selections remained unchanged. Although there are major differences in beverage offerings between the garrison and IMT menu standards, the beverage selections remained unchanged due to the complexity of data collection and unlimited refills allowed in the DFAC. A full comparison of the garrison and IMT menu standards (food selections only) are included in Appendix C.

While using digital photography methods to estimate both food selection and consumption was initially considered for the study, based on the preliminary investigations and plate waste observations conducted for this study, determining food consumption using digital photography and direct observation methods only would not yield accurate results. Therefore, weighing food plate waste was applied to determine food consumption.

Pilot Study

In order to assess the accuracy and feasibility using both digital photography and plate waste methods to determine food selection and consumption, a pilot study was conducted one menu cycle prior to the actual data collection day. All research assistants were assigned to stations (e.g., recruitment, salad bar observation, digital photography, plate waste, and survey return stations) and trained on what and how to perform tasks. Prior to the start of the lunch meal service, reference portion sizes for each food item served were determined using established protocol. A total of 50 patrons were recruited as they entered the DFAC. Interested

patrons were provided a blank brightly colored laminated 3 x 5 inch tray card and asked to write an easily remembered four-digit code on it. Black sharpies were used to write the number so that it was clearly visible to the salad bar observers and in the digital photographs. After writing a four-digit number on the card, participants were asked to place the laminated tray card on their dining tray and to ensure it was visible at all times. They were also instructed to leave the card on the tray throughout their meal until their tray returned to the dish room.

After leaving the recruiting stations, participants made food and beverage choices. Research assistants were located at each of the self-service areas (e.g., salad bar) to directly observe food selections and the amounts on an observation form. Prior to sitting down to consume their meals, participants proceeded to one of two digital photography stations set-up near the main seating areas. Research assistants took photos of marked trays after making any adjustments to ensure all food selections were visible in the photograph. If it was difficult to determine what and how much food was selected (e.g., closed sandwiches), research assistants asked participants to clarify or show the content by removing the bread and annotated information on an observation form.

Following meal consumption, participants were directed to the tray return and asked to leave their laminated tray cards on their food tray. After marked trays reached the dishroom, they were collected by research assistants and taken to a photography/weighing station set-up in the dishroom. Each leftover food item was carefully weighed using a calibrated, 11-pound capacity digital scale. Items were weighed to the nearest gram and results were annotated on an established form.

In order to determine food consumption, food waste was adjusted to reflect the edible portion consumed, when applicable, and subtracted from the weight of the reference portion. All recipes were analyzed using the established protocol and nutritional information was calculated based on the reference portion size. For food items that were pre-made or were offered “as-is” and did not require any food preparation (e.g., sliced bread or peanut butter packets), the food item description was obtained and nutritional information of the individual package or reference portion was obtained from the USDA Nutrient Database for Standard Reference (USDA Agricultural Research Service, 2013) after verifying the serving size (e.g., checking to see the portion sizes are consistent with the package information). Nutrient consumed from each food item was calculated based on nutrient analysis results for the amount of each food item

consumed. Nutrition intake of each participant was calculated by adding nutrient information from all food items consumed.

Following the pilot data collection day, all necessary adjustments were made to processes and procedures and protocols in order to improve accuracy and efficiency of data collection. Specifically, a brief set of instructions was printed on the back of each laminated tray card as a reminder for participants, salad bar observation forms were modified to improve the accuracy of participants' selections, and the plate waste photograph station was relocated to a different area in the dish room to improve the efficiency of plate waste data collection. Also, additional training was provided to both research assistants and food service staff, as needed, prior to the baseline data collection day.

Reference Portion Size Determination

A three-week lunch/dinner menu cycle was established for both the garrison and IMT menus. Each cycle was repeated once during the data collection period. Reference portion sizes, which reflected a typical portion size served, were determined for each menu item served on data collection days, and included main line, short order, and specialty bar items. Reference portions were also determined on the pilot data collection day so that research assistants could become familiar with the data collection forms and established protocol.

Prior to the start of the lunch meal, the assigned server served ten food portions for each food item in a normal fashion using the appropriate serving utensil. Each portion was carefully weighed using a calibrated 11-pound capacity digital scale. The mean weight of the ten served portions of each food item was considered its' reference portion size. Reference portions for dessert items, which are pre-portioned, were each calculated by randomly selecting and weighing ten portions of each item, then determining the mean weight for each item. All reference portion sizes were determined prior to the start of the meal in order to minimize disruptions during service.

Employees did not control self-service items, such as the salad bar and some specialty bar items. For these items, reference portions were established by averaging the weight of ten single serving portions (e.g., one tong-full of shredded cheese) of each item. During the meal period, research assistants were located near each self-service area and directly observed participants' food selections and amounts. These observations, along with the participant's tray number, were

annotated on a form (Appendix F) then later used to determine food consumption and nutrient intake.

Data Collection

On both data collection days, recruitment occurred near the two entrances of the DFAC. Soldiers interested in participating were provided a blank, brightly colored, laminated 3 x 5-inch tray card and asked to write an easily remembered four-digit number (e.g., the last four digits of their cellular phone number) on it. They were instructed to place the card on their food tray and ensure it remained visible while making food selections. A brief set of instructions was printed on the back of each laminated card for participants to review, if needed.

Two identical digital photography stations were set-up near each of the two main dining areas to photograph trays after selection and prior to consumption. An additional photography station was set up in the dish room to photograph trays after consumption and prior to tray discard. In the dish room, leftover food items were also weighed using a digital scale.

Each station was equipped with a small digital camera (e.g., Canon “PowerShot” SD 1400 IS) positioned on a tripod. All cameras were set at a 45-degree angle approximately 20” above the food. A tray mat was created and attached on the table for consistent tray placement, and two rulers (one placed vertically and one placed horizontally) were used as reference points for each photograph. Research assistants attended each station taking photographs of food trays. Assistants ensured all food choices and the tray number were visible before taking the photograph. Any participant who received second portions of food returned to the photograph station and had additional portions photographed prior to consumption.

After initial food selections were photographed, research assistants provided participants a consent form and survey. Each participant was instructed to read and sign the consent form (Appendix D), and complete the survey (Appendix E) while they consumed their meal and return them before leaving the facility.

Survey return stations staffed by research assistants were set up near each of the two tray return areas. Research assistants collected participants’ surveys and signed consent forms. All surveys were reviewed, and participants were asked to finish the survey if it was incomplete. Participants were instructed to leave their laminated card on their food tray and place the tray on

the tray return. Assistants provided a small token (keychain flashlight, ball point pen, and/or trail mix snack) to those soldiers who completed participation.

Three research assistants were located in the dishroom to collect returned food trays and photograph, weigh, and record plate waste. Once trays were returned to the dishroom, those with laminated tray cards were removed from the tray return so that dishwashing operation was not interrupted. Trays with leftover food items were first photographed then left over food items were weighed to the nearest gram using a calibrated digital scale and recorded on the weight record sheet provided (Appendix G). Photographs of returned trays were taken in order to verify that all food items left on the tray were weighed and recorded. Participant trays returned empty were not photographed. In order to reduce confusion during analysis, laminated tray cards removed from empty trays were separated from those removed from non-empty trays.

Food waste was adjusted to reflect the edible portion consumed, when applicable, and subtracted from the reference portion size weight to determine food consumption. All recipes were analyzed using the established protocol and nutritional information was calculated based on the reference portion size. Food items selected by participants were labeled either red, yellow or green based on the Army's standardized nutrition labeling system, *Go for Green* (U.S. Army Food Service, 2012). The total number and percentage of red-, yellow- and green-labeled items taken were determined for each participant.

Data Analysis

Once all photographs, observation and weight forms were organized, food selection, consumption, and nutrient intake were determined for each tray. All data were matched using the four-digit code provided by the soldiers. If there was no matching photographs before and after consumption, data were not included in the data analysis. There were several cards with duplicate code numbers (e.g., 1111, 1234). In order to match before and after consumption photographs, handwriting and food choices identified in the photos were used to match photographs and surveys.

Participants' food selections were identified using photographs and observation forms (Appendices F and G) then labeled according to the Army's *Go for Green* Nutrition Labeling Program (U.S. Army Food Service, 2012). The weights of all plate wastes and *Go for Green* label for each food item were entered into a Microsoft Excel spreadsheet. Red-, yellow-, and

green-labeled items selected by each participant were summarized, and the amount of food consumption was determined by subtracting plate waste weight from the reference portion weight.

Independent samples t-tests were conducted to establish significant differences, if any, in food selection and nutrient consumption between the two menus. All data were analyzed using the Statistical Package for Social Sciences (SPSS) (version 21.0, 2012). Significance levels were set at $p \leq 0.05$.

Assessment of Soldiers' Perception of Their Health Status and Meal Satisfaction

Overview

The other primary aspect of this study was to determine if 1) there were differences in soldiers' satisfaction and acceptability between the garrison and IMT menus, and 2) if any relationships existed between factors related to soldiers' attitudes toward health, nutrition knowledge and reported and actual food selection and consumption behaviors. In order to address the hypotheses surrounding these specific constructs, a quantitative survey was developed. The following sections provide detailed information about the methods used to develop, pilot test, and administer the survey, as well as analyze the survey results.

Instrument Constructs

After review of pertinent literature related to the study's constructs, a self-administered questionnaire was developed. There were four main constructs assessed – reported eating behaviors, nutrition knowledge, attitudes toward health and satisfaction with overall dining experience. Participants also indicated perceived hunger and satiety levels before and after their meal. Lastly, demographic questions including gender, age, rank, height, weight, years of military service, education level, meal card status, and Army weight control program enrollment were included. Multiple-choice, multiple answer, and short answer formats were used.

Reported Eating Behaviors

In this section of the survey, six questions were included to determine participants' typical eating behaviors. Typical meal selections, breakfast intake, fried food and fruit/vegetable

consumption, and typical sugar-sweetened (SS) beverage intake was asked to identify reported eating behaviors. In order to establish consensus regarding the most common and pertinent health-related food behaviors addressed to soldiers during nutrition counseling, a preliminary survey was administered to a panel of 20 Army dietitians who regularly provide nutrition education to soldiers. Each panel member was asked to list the top five nutrition-related behaviors addressed with soldiers during an education class or individual counseling session. The top five health-related food behaviors listed were then used to help develop questions that capture soldiers' current food behaviors. Questions included multiple answer, multiple choice, and short answer formats (Appendix E).

Nutrition Knowledge

In this section of the survey, participants were asked questions related to basic nutrition knowledge and healthy food choices. To ensure questions asked in this section were relevant and not too easy or difficult for the population of interest, several nutrition questions were developed then reviewed by 20 Army dietitians who regularly provide nutrition counseling to soldiers. The ten questions that were considered the most appropriate by the pool of reviewers were retained for the survey. Questions were asked using multiple choice format. Table 3.6 provides examples of questions used in this section and Appendix E includes all 10 nutrition knowledge questions.

Attitudes Toward Health

This component of the survey involved a series of statements that addressed participants' overall attitudes toward eating a healthy diet and making healthy food choices. Constructs from the Health Belief Model (HBM), which has previously been shown to successfully measure perceptions about dietary quality and the likelihood of eating a healthy diet (Deshpande, Basil, & Basil, 2009; Sapp & Jensen, 1998; Sapp & Weng, 2007), were used to address participants' beliefs toward eating a healthful diet. Four of the five independent variables used in Sapp and Jensen's (1998) original study were addressed – *perceptions of current dietary quality*, *perceived importance of eating a quality diet*, *perceived benefits and barriers to eating a quality diet*, and *cues to action about eating a quality diet*. *Awareness of diet-health relationships* was the one independent variable not addressed because of its irrelevance to the purpose of the study and population of interest.

Table 3.6 Selected nutrition knowledge questions and answers

Sample Question	Possible Answers
1. Which nutrient would be the best to consume prior to engaging in sustained physical activity lasting approximately an hour?	a) protein b) fat c) complex carbohydrates d) alcohol e) I don't know
2. According to the USDA's "Choose My Plate" guidelines, approximately how much of your plate should be filled with fruits and/or vegetables?	a) 1/4 b) 1/3 c) 1/2 d) 3/4 e) I don't know
3. Which of the following choices would be considered safe and effective weight loss?	a) 0.5-1 pound per week b) 1-2 pounds per week c) 3-5 pounds per week d) as many pounds as possible each week e) I don't know

Perceptions of current dietary quality was measured using one question with a Likert-type scale answer format (very unhealthy/very healthy). *Perceived importance of eating a quality diet* was measured through a series of nine statements using a five-point likert scale (very unimportant/very important). *Perceived benefits and barriers to eating a quality diet* and *Cues about eating a quality diet* were measured with a series of eleven and five statements, respectively, using a five-point likert scale (strongly disagree/strongly agree).

Satisfaction with Overall Dining Experience

The last section of the survey explored overall dining experience and also included demographic questions. Participants were asked to complete this portion of the questionnaire

following their meal. A series of fifteen statements were developed that measure service and food quality, portion size adequacy, food accessibility, menu variety, healthy menu options and return intentions. All statements were measured using a five-point Likert scale (agree/disagree).

Participants were also asked in the survey to report what their hunger level was right before meal consumption and their satiety level immediately following the completion of their meal. Reported hunger and satiety levels were measured using an eleven-point Likert-type scale (greatest imaginable hunger/greatest imaginable fullness). Verbal labels used for the scale were extracted from the Satiety Labeled Intensity Magnitude (SLIM) scale, a reliable and simple scale that uses verbal labels of hunger/fullness in order to measure perceived satiety (Cardello, Shultz, Leshner, & Merrill, 2005).

Expert Review and Validity Determination

In order to establish content and face validity, and to receive feedback for revisions, the initial survey was reviewed by an expert panel review consisting of five military dietitians and four food service management researchers. Revisions were made based on expert panel feedback and finalized for pilot test (Appendix E).

Pilot Test

One month prior to the data collection period, 50 soldiers from Cantigny dining facility, also located on Ft. Riley, were recruited to participate in a pilot study in order to evaluate the readability of questions and statements, instruction clarity, survey flow, and the internal consistency of constructs. Those that elected to participate were provided a consent form and a survey, and a small token was given to those who completed and returned the survey.

Extra spaces were provided after each survey section for participants to write comments and provide feedback. Internal consistency of each construct was determined using average inter-item correlations, with a Cronbach's alpha test with $\alpha \geq 0.70$ as a standard. Based on the results of the pilot test, no additional changes needed to be made to the survey. Pilot test data was not included in the final survey analysis.

Data Collection

Throughout the lunch period on data collection days, soldiers were recruited to participate in the study. Those soldiers interested in participating were provided a consent form,

participant instructions, a survey, and a small laminated card. Participants were asked to create a four-digit code they could easily remember. Once a code was determined, they were instructed to write the code on their laminated card and at the top of their survey questionnaire. The four-digit code was used to match the survey to the food selection and consumption photographs. Participants were asked to complete and return the survey before departing the DFAC. Survey-return stations were located near the tray return areas and exit doors.

Data Recoding and Analysis

Using the established coding system, surveys were matched with before consumption photographs. All responses were analyzed using the Statistical Package for the Social Sciences (SPSS) (version 21.0, 2012) and significance levels were set at $p \leq 0.05$.

Dependent variables included reported food behaviors (continuous) and overall attitudes toward health (dependent and independent, continuous). Independent variables included age (ordinal), gender (dichotomous), perceived hunger and satiety levels (continuous), body mass index (BMI) (ordinal), education levels (ordinal), military rank (ordinal), weight control program enrollment (dichotomous), years of military service (ordinal), attitudes toward health (continuous), and nutrition knowledge (dichotomous and continuous [sum of correct responses]).

Reported Food Behaviors

Typical meal selections included three different entree, starch, vegetable and dessert items for participants to choose from as well as a write-in option. All responses were coded as a red, yellow or green labeled item based on the Army's *Go for Green* labeling criteria (U.S. Army Foodservice, 2012). Red-labeled items were coded to a 1 (one), yellow-labeled items a 2 (two), and green-labeled items a 3 (three). After items were coded, the total number of green-labeled items was calculated. Typical meal selections were defined as the percentage of green-labeled items and calculated using the following equation:

$$\text{Food selection} = \frac{\text{total number of green items selected}}{\text{total number of food items selected}}$$

Food selection was determined for each participant and used for further statistical analysis.

Breakfast frequency and fruit/vegetable consumption questions included six possible responses to determine participants' typical intake. All "I don't know" responses were treated as missing data. Not consuming breakfast any days of week and no intake of fruits/vegetables at

meals were coded a 1 (one). Consuming breakfast every day and 100% of plate filled with fruits/vegetables at meals were coded a 5 (five). Fried food consumption was reverse coded. “I don’t know” responses were treated as missing data, choosing four fried food items at a meal was recoded to a 1 (one) and not selecting any fried foods was recoded to a 5 (five).

Sugar-sweetened (SS) beverage consumption was evaluated based on mean weekly consumption. A prompt question was used to identify if participants consumed SS beverages on a regular basis. Participants answering “yes” were asked to list the amount of 12, 16 and 20-oz. containers of SS beverages consumed each day and/or week. Daily amounts reported were multiplied by seven then added to weekly amounts in order to determine participants’ reported weekly consumption of SS beverages. Perceived hunger and satiety levels were determined using an 11-point Likert scale. Greatest imaginable hunger responses were coded a 1 (one) and greatest imaginable fullness coded to an 11.

Attitudes Toward Health

In order to evaluate attitudes toward health, a five-point Likert scale (strongly agree/strongly disagree or very important/very unimportant) was used to measure responses. Descriptive statistics were calculated to evaluate the mean and frequency of responses to each question.

In addition to descriptive statistics, an alternative measure was developed to place each response was placed into one of two categories: “endorsed” or “not endorsed”. Endorsed items were those the participant rated as a 4 (four) or a 5 (five) on the five-point Likert scale, while all other responses (3, 2 or 1) were considered items not endorsed. Endorsed items were recoded to a 1 (one) and not endorsed items were recoded to a 0 (zero). The total number of endorsed items were computed and allowed the researcher to count the number of items (e.g., barriers, cues to action) participants agreed on. The computed sum of endorsed items for each construct was also used for regression analysis to determine if attitudes toward health influenced reported and actual food behaviors.

Nutrition Knowledge

Nutrition knowledge questions were written using a multiple choice format and contained one correct response. Correct responses were recoded to a 1 (one) and incorrect or “I don’t know” responses were recoded to a 0 (zero). The total number of correct responses to nutrition

knowledge questions was calculated using the compute function of SPSS and used for further statistical analysis. The computed sum of nutrition knowledge measurement was used for descriptive statistics calculations and regression analysis to determine if nutrition knowledge influenced reported and actual food behaviors.

Satisfaction with Overall Dining Experience

In order to evaluate overall dining experience, a five-point Likert scale (agree/disagree) was used. “I don’t know” responses were reported as missing data, strongly agree responses were recoded to a 5 (five) and strongly disagree responses recoded to a 1 (one). Responses to items relating specifically to service quality (n = 6) and food quality (n = 9) were totaled using the compute function and used for further statistical analysis.

Overall Data Analysis

Descriptive statistics, including means, frequencies, and standard deviations were calculated for all independent and dependent variables. Independent samples t-tests were calculated when comparing satisfaction with overall dining experience as well as demographic characteristics before and after implementing IMT menu standards. They were also calculated when comparing actual food selection and intake based on gender, rank, years of service, meal card holder status, and weight control program enrollment. One-way ANOVA was calculated when comparing responses among the different age, BMI, and education level groups with actual food selection and intake.

Regression analyses were used to determine if 1) attitudes toward health influenced reported and actual food behaviors, 2) nutrition knowledge influenced overall attitudes toward health, and 3) nutrition knowledge influenced reported food behaviors. Pearson bivariate correlations were used to evaluate associations between nutrition knowledge and actual food selection and consumption, and perceived hunger/satiety levels and actual food selection and consumption.

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Chapter 4 - Factors Influencing Selection and Nutrient Intakes of Non-Training Army Dining Facility Patrons

Abstract

The purpose of this study was to identify factors that influence reported and actual food selection and consumption behaviors of soldiers in a non-training status. Participants were recruited during a lunch period in one Army dining facility (DFAC). Soldiers' food selection and consumption were assessed using observations, digital photography, and plate waste methods and evaluated using the Army's *Go for Green* Nutrition Labeling Program and the Military Dietary Reference Intakes (MDRI). A survey was also administered to determine soldiers' attitudes, nutrition knowledge, and reported food selection and consumption behaviors. Descriptive and inferential statistics were calculated to summarize and identify potential associations among variables. A total of 172 soldiers (mean age=25 years) participated in the study. Most of the nutrients reviewed exceeded 1/3 of MDRI. With the exception of sugar-sweetened (SS) beverage consumption, attitudes toward health were associated with all reported food behaviors ($p<0.01$) but not with actual food selection and consumption behaviors ($p>0.05$). Nutrition knowledge significantly influenced some but not all aspects related to attitudes toward health. Perceived hunger levels were the only factor that was positively associated with intakes of calories, protein, total fat, sodium, and cholesterol ($p<0.05$). Our findings suggest that nutrition knowledge and attitudes toward health appeared to be associated only with reported food selection and consumption behaviors but not with actual behaviors for this population. Perceived hunger and available food served seem to be the only influences affecting soldiers' behaviors. Registered dietitians may use these results when developing strategies to improve food selection and consumption of this and other young populations.

Background

Obesity remains a serious health problem in the United States (U.S). In 2010, 35.7% of all adults and 16.9% of children and adolescents were considered obese (Ogden, Carroll, Kit, & Flegal, 2012). In 2012, state-wide obesity prevalence reached an all-time high with 13 states reporting obesity rates between 30 and 35% (Centers for Disease Control and Prevention [CDC], 2012). In recent years, the U.S. military has been negatively impacted by the nation's rising obesity rates, and has experienced increased obesity rates among current service members, a decreased recruitment pool, and an influx of weight-related retention issues (Bray et al., 2009; Hsu, Nevin, Tobler, & Rubertone, 2007; Packnett, Niebuhr, Bedno, & Cowan, 2011; Yamane, 2007).

It is well known that making nutritious food choices on a regular basis is a key strategy for obesity prevention and overall health (The American Dietetic Association, 2009). In order to combat the escalating weight-related problems among military personnel, several nutrition programs and initiatives have been developed to improve the quality of soldiers' food choices. Many are implemented in Army dining facilities (DFACs) and incorporate nutrition education tools that not only promote good nutrition, but also enable diners to make informed food and beverage choices. DFACs have become the ideal location for such programs because these eating establishments are utilized by thousands of service members on a daily basis (Bray et al., 2009). Point-of-purchase nutrition labeling was one of the programs initially used in DFACs to provide soldiers with the nutrition information for meal selections (Sproul, Canter, & Schmidt, 2003). While point-of-purchase nutrition labeling programs have been effective in other foodservice settings, such as university cafeterias (Chu, Frongillo, Jones, & Kaye, 2009), they were not as effective for improving military diners food choices (Sproul et al., 2003).

In 2012, point-of-purchase calorie labeling in military DFACs was replaced with a more simplified nutrition labeling system called *Go for Green*, which places color coded labels on meal selections and encourages diners' to choose more high-performance, nutrient-dense food and beverage options (U.S. Army Food Service, 2012). While it is unknown how effective this system for improving nutrient quality of soldiers' dining selections, similar programs implemented in civilian worksite cafeterias were found to be overall ineffective for improving meal selections (Freedman & Connors, 2010; Hoefkens, Lachat, Kolseteren Van Camp, & Verbeke, 2011; Vyth et al., 2011).

Beyond simply informing soldiers' about the healthfulness of food selections, a more aggressive strategy was explored that sought to improve the healthfulness of offerings through changes to standardized menus. Although such menu changes were found to be effective for improving nutrient intakes without compromising overall satisfaction, this strategy did not improve the overall quality of food selections (Crombie et al., 2013).

Several factors influence the quality of an individual's food selection behaviors such as taste, convenience, and price (French, 2003; Glanz, Basil, Goldberg, & Snyder, 1998). In addition, several researchers found that attitudes towards healthy eating and nutrition knowledge contribute to one's likelihood of making nutritious food choices (Deshpande, Basil, & Basil, 2009; Kolodinsky, Harvey-Berino, Berlin, Johnson, & Reynolds, 2007; Sun, 2007). While it can be speculated that the influence these factors have on food selections of military diners' is similar to other populations studied, no research exists to confirm this.

Therefore, the purpose of this study was to evaluate soldiers' nutrition knowledge and attitudes toward health, and determine if these and other factors influence food selections and meal nutrient intakes of soldiers in a non-training status. As the Army continues to explore options that promote healthy eating among service members, this research aimed to strengthen current and future initiatives by identifying what influence, if any, attitudes toward health and nutrition knowledge have on military diners' meal selections and nutrient intake.

Methods

Subjects

The target population of this study was soldiers in a non-training status who dine in Army DFACs. The location for the research was a large DFAC on an Army base in a Midwestern region of the U.S. where 1200-1500 soldiers dine each weekday. Although only one location was chosen, soldiers on this military installation are considered a good representative sample of the target population because they are from all areas of the U.S. and are considered soldiers not in training. Participants were first notified of the study a week prior using flyers and posters placed in highly visible locations within the DFAC and then recruited on the data collection day, more specifically, during their lunch meal period. The day for the data collection was selected because it was a typical weekday of the operation and expected to have a high participation rate. Participants were recruited at each of the two main facility entrances throughout the 90-minute

meal period. Service members not eating their meals in the DFAC (e.g., utilizing the take-out option), diners other than service members (e.g., Department of the Army civilian employees, civilian family members, and visitors) and DFAC staff members were excluded from participating in the study. The study was approved by the Institutional Review Board of a university and the Institutional Review Board, Madigan Army Medical Center, Fort Lewis, WA.

Instrument and Study Protocol Development

Two main components of data collection methods were developed for this study. The first component involved methods used to determine food selection and consumption and the second included a survey to assess participants' nutrition knowledge, attitudes toward health, reported food selection and consumption behaviors, and demographic characteristics.

Food Selection and Consumption

For this study, various food intake estimation methods were used in combination to determine participants' food selection and consumption. Digital photography methods, which have been used previously in foodservice settings to estimate intakes, (Crombie et al., 2013; Williamson et al., 2003, 2004) were used to estimate participants' food selections. Although previous studies (Crombie et al., 2013; Williamson et al., 2003, 2004) estimated food served and left on the plates using digital photography methods, the preliminary data collection trial revealed that reliability of such an estimation method could not be established for this study setting. In addition, the reference portion sizes in the previous studies were based on standardized recipe portion sizes, but our preliminary evaluation showed discrepancy between the standardized recipe portion sizes and actual serving sizes. Therefore, researchers determined not to use the digital photography methods for estimating food served and left at the end of the meal, but was used to identify meal selections only.

Food selection was identified by photographing participants' food trays at one of two identical digital photography stations after food and beverage selections were made. Each photograph station was equipped with a digital camera (e.g., Nikon D3100) positioned on a tripod and set at a 45-degree angle approximately 20" above the food. Tray mats were used for consistent tray placement, and rulers were placed horizontally and vertically next to each tray as photograph reference points.

For self-service items, direct observation methods (Ball, Benjamin, & Ward, 2007; Gittelsohn, Pokhrel, Shankar, & West, 1994) were used to determine food selection and estimated quantity of food. The researchers established reference portions prior to data collection by repeated measures ($n = 10$) of each portion served and self-served items using the standardized serving utensils. Research assistants located at each self-service area (e.g., salad bar) observed participants' food selections and annotated tray numbers, the type and amount of each food item selected on an observation form. Data collected from observations were used to assist with assessing participants' food selections and the amount of food placed by soldiers.

In addition, plate waste methods (Adams, Pellether, Zive, & Sallis, 2005; Templeton, Marlette, & Panemangalore, 2005) were used to estimate the quantity of food left on each plate. In order to estimate plate waste, participants placed their food tray and tray card on the dishroom tray return after meal consumption. Once trays reached the dishroom, research assistants collected them and photographed trays with leftover food items before weighing each food to the nearest gram using a calibrated digital scale. Food item weights and tray numbers were recorded on a plate-waste recording form and used for analysis.

The nutrition quality of participants' food selections was determined using the Army's *Go for Green* nutrition labeling system (U.S. Army Food Service, 2012), a program implemented in all Army-operated DFACs, including the data collection facility, to encourage patrons to make nutritious food choices. The *Go for Green* program establishes a color code system based on a food or beverage's total calories and nutrient content. Items high in calories, sugar and/or fat, and low in nutrients are labeled red and items labeled yellow are moderate in calories, sugar and/or fat, and nutrients. Green-labeled items are considered optimal choices and are highest in nutrient quality and low in calories, total fat and/or sugar.

Food consumption was determined by taking the reference portion minus the weight of plate waste of each food item. Reference portion sizes were established by the mean weight of 10 typical portions served by DFAC employees and self-service food items prior to the start of the lunch meal. The mean weight for each food item was calculated and later used for food consumption and nutrient analysis.

Nutrient intakes were analyzed based on amount of food consumed and included total kilocalories, total fat, saturated fat, dietary cholesterol, protein, total carbohydrates, dietary fiber, iron, vitamins A and C, and sodium. Reference portion sizes for individual food items and

standardized recipes were analyzed using the United States Department of Agriculture (USDA) Nutrient Database for Standard Reference, release 26 (USDA Agricultural Research Service, 2013).

Food intake and consumption methods were piloted tested with 50 patrons during lunch at the selected DFAC one menu cycle prior to the data collection day. All noted improvements and necessary changes were made to the established methods prior to data collection.

Food Behaviors, Nutrition Knowledge and Attitudes Toward Health Assessment

Based on a literature review, a 50-item survey was developed to assess key variables of interest and participants' demographic characteristics. The instrument included questions regarding nutrition knowledge ($n = 10$), perceived importance of eating a healthy diet ($n = 9$), perceptions of the healthfulness of their current diet ($n = 1$), benefits ($n = 4$) of and barriers ($n = 6$) to eating a healthy diet, cues to action ($n = 5$), typical food selection and consumption behaviors ($n = 5$), and perceived hunger and satiety levels ($n = 2$).

Demographic information ($n = 9$) was included to characterize the participants (e.g., age, gender, years of service, etc.). In addition, height and weight were asked to assess BMI of soldiers to identify any differences in knowledge, attitudes and behaviors based on current weight status.

Typical food behavior questions used multiple answer and multiple choice formats, and participants' knowledge of general nutrition topics were assessed using multiple choice questions. Questions addressing attitudes toward health were measured using a five-point Likert scale. Perceived hunger and satiety levels were rated using an 11-point Likert scale (1 being greatest imaginable hunger, 6 being neither hungry nor full, 11 being greatest imaginable fullness).

Content and face validity for typical food behavior and nutrition knowledge questions was established using an expert panel of Army dietitians ($n = 20$). The final survey instrument was reviewed by a panel of military and university foodservice experts and researchers ($n = 9$), then pilot tested during lunch at another DFAC with 30 soldiers one month prior to data collection.

Data Collection

Following the aforementioned protocol, participants were recruited and completed both the survey and analysis of food selection and consumption. Eligible soldiers interested in participating were provided a brief explanation of the study and a blank, brightly colored laminated tray card with instructions on the back. Participants were asked to write a self-created, four-digit code on the front of their tray card and place it number-side up on their tray. Participants made their food and beverage selections and proceeded to one of two digital photography stations set up near the main seating areas. After photographing the tray, research assistants provided participants with a consent form and survey. Participants were instructed to write their self-created four-digit code at the top of the survey in the space provided and to complete the survey while eating their meal. After completing their meal, research assistants located near the tray return area collected surveys, which were reviewed for completion, and signed consent forms. Copies of blank consent forms were available for participants upon request. Those completing the study were offered a small token of appreciation (e.g., keychain flashlight).

Data Recoding and Statistical Analysis

Nutrient Quality

The two outcome variables for this study measuring soldiers' nutrition quality included food selection quality and nutrient intake. Food selection quality was defined as the percentage of green-labeled, according to the Army's *Go for Green* program, food items selected and calculated using the following equation:

$$\text{Food selection} = \frac{\text{total number of green items selected}}{\text{total number of food items selected}}$$

Nutrient intake, with the exception of dietary fiber, was defined either as a percentage of the daily military dietary reference intakes (MDRI) or established macronutrient meal guidelines outlined in Army Regulation (AR) 40-25, *Nutrition Standards and Education* (Headquarters Departments of the Army, Navy and Air Force, 2001). Nutrient intake was evaluated based on whether a subject met or exceeded one-third of the MDRI or established meal guidelines.

Nutrition Knowledge, Attitudes toward Health, and Reported Behaviors

Descriptive statistics were calculated to summarize the data for all survey questions. Microsoft Excel was used to calculate BMI of soldiers for further analysis. Nutrition knowledge questions were coded as 1 (one) for correct and 0 (zero) for incorrect answers. The total nutrition knowledge score was calculated using compute function of SPSS and ranged 0 to 10 points.

Attitudes toward health were measured using 5-point Likert-type scales. In addition to descriptive statistics, the responses were placed into two categories: “endorsed” or “not endorsed”. Endorsed items were those items the participant either agreed or strongly agreed, which were responses of 4 or a 5 on the five-point Likert scale, while all other responses (neutral, disagree or strongly disagree) were considered not endorsed. Endorsed items were recoded with a 1 (one) and items not endorsed with a 0 (zero). Total number of endorsed items was calculated using the compute function, and used for further statistical analysis.

Five items addressed reported food behaviors. Typical food selections included three different entrees, starches, vegetable, and dessert choices for participants to select as well as a write-in option. Answers, including write-ins, were recoded based on the *Go for Green* labeling system. Red-labeled items were coded to a 1 (one), yellow-labeled items a 2 (two), and green-labeled items a 3 (three). The number of green-labeled items was calculated using the compute function in SPSS and percentage of green-labeled items selected was determined using the aforementioned food selection equation. Multiple answer format questions addressed breakfast frequency, fried food consumption, and fruit/vegetable intake. Answers to breakfast frequency and fruit/vegetable intake were coded 0 (zero) through 5 (five), with “I don’t know” option treated as missing data and maximum intake/consumption assigned a 5 (five). Fried food consumption was coded similarly except it was reverse coded (e.g., 5 for no fried food choices per meal and 1 for 4 fried food selections per meal).

For participants who answered consuming SS beverages regularly, additional questions were asked to list the total number of 12, 16 and 20- ounce containers of SS beverages consumed daily and/or weekly. The amount of SS beverages consumed per week was calculated for analyses. Hunger and satiety levels were coded 1 (one) through 11, with greatest imaginable hunger coded a 1 (one) and greatest imaginable fullness coded an 11. Overall food selection and consumption behaviors scores were calculated for further analysis.

All analyses were performed using IBM SPSS software (version 21.0, IBM Corporation) with $p < 0.05$ for statistical significance. Descriptive statistics were used to summarize the participants' demographic characteristics and survey responses. Pearson bivariate correlation coefficients were calculated to evaluate relationships between variables. Logistical and multiple regression analyses were used to examine relationships between and among independent and dependent variables. One-way ANOVA and independent samples t-tests were used to examine food selection and intake based on demographic characteristics.

Results

A total of 172 soldiers agreed to participate in the study and of these, 154 surveys were returned and 135 sets of matched photographs were collected before and after the meal. Using the self-created four-digit code, 105 surveys and sets of photographs were matched and used for statistical analysis.

On average, participants were 24.9 years old (SD = 6.1) with a BMI of 25.9 (SD = 3.1). The majority of the participants were between the ages of 19 and 25 years old (64%) and had a BMI greater than 25.0 (62%). Most of the participants were male (93%) and meal card holders (80%) (soldiers provided meals on behalf of the government), at the rank of E1-E4 (79%), had completed ≤ 3 years of military service (74%), and possessed a high school diploma (68%). Only a limited number of participants (4%) were enrolled in the active duty weight control program (ADWTC) due to overweight status.

Descriptive statistics for participant nutrient intake are provided in table 4.1. On average, participants consumed 847 calories comprised of 41% carbohydrates (net), 18% protein, and 41% fat. Over half of the participants consumed 33% of the MDRI for protein, iron, vitamin C and cholesterol, while 18% met the recommended intakes for vitamin A. The mean percentages of green-, yellow- and red-labeled items selected were 38%, 19% and 42%, respectively.

<Insert Table 4.1 Here>

Participants' reported food selection behaviors were better than the actual food selection behaviors. The mean percentages of reported green-, yellow-, and red-labeled choices were 57%, 21%, and 22%, respectively. Participants reported they ate breakfast most days of the week (5-6 breakfasts per week), and 37% reported eating breakfast every day. Seventy-two

percent reported they chose at least one fried food item at a meal, and 29% indicated that they filled one-half of their plate with fruits and/or vegetables. A majority (79%) of the participants reported that they consume SS beverages (e.g., regular soda, sweetened tea, etc.). The mean score of total volume of reported SS beverage consumption per week was 236 ounces, with 49% of participants consuming at least 150 ounces weekly.

The mean nutrition knowledge score was 6 of 10, and two-thirds of subjects answered at least 50% of the answers correctly. Twenty-eight percent of participants answered at least 80% of the questions correctly while 21% answered 30% or less of the questions correctly.

Table 4.2 lists frequencies and percentages of participants' endorsement of items relating to attitudes toward health. The survey results indicated that, on average, soldiers perceived their diets to be healthy, and 24% stated their diet was neither healthy nor unhealthy. At least 90% of participants endorsed items relating to benefits of eating a healthy diet. On average, soldiers identified two barriers (33%) to eating a healthy diet, with convenience and influence of others being the most common barriers identified. A majority of items relating to the importance of eating a healthy diet were endorsed (67%) with variety (79%) and fruit/vegetable intake (75%) most frequently endorsed. On average, two of five (40%) cues to eat a healthy diet were endorsed, with food labeling (55%) and recommendation by a family member (52%) being the most frequent cues endorsed.

<Insert Table 4.2 Here>

Results related to perceived hunger and satiety levels indicated that participants were, on average, very hungry (Mean = 3.0 on the 11-point scale) prior to meal consumption, with 22% reporting extreme or greatest imaginable hunger levels (1 or 2). Following the meal, mean satiety levels were rated as moderately to very full (Mean = 8.6 on the 11-point scale) and 25% reported being extremely full or experiencing greatest imaginable fullness (10 or 11).

Factors Associated with Food Selection and Consumption Behaviors

Pearson correlations and significance levels between perceived hunger levels and primary outcome variables are presented in table 4.3. Intuitively, greater hunger levels were associated with higher intakes of kilocalories, protein, cholesterol, sodium and total fat, and saturated fat. Likewise, soldiers who consumed higher kilocalories reported being very satiated following their

meal. The hungrier soldiers felt before coming to eat lunch, the more full they felt after the meal.

<Insert Table 4.3 Here>

Participants with a BMI of 30 or greater ($n = 15$) selected significantly more green-labeled items compared to those with a normal BMI. Also, meal card holders consumed significantly more carbohydrates and less cholesterol than cash-paying customers ($p < 0.05$), and females consumed significantly less fiber ($p < 0.01$) and exceeded 33% MDRI for kilocalories compared with males ($p < 0.05$). Lastly, younger soldiers consumed significantly more carbohydrates than older soldiers ($p < 0.05$).

Participants who reported selecting more green-labeled items on the survey consumed greater amounts of vitamin A ($r=0.21$; $p<0.05$). Increased frequency of breakfast consumption was associated with lower intakes of total fat ($r=-0.20$; $p<0.05$) and those with higher nutrition knowledge scores consumed greater amounts of protein ($r=0.23$; $p<0.05$). No significant correlations were found between SS beverage consumption and outcome variables. Overall attitudes toward health were associated with the amount of protein consumption ($p<0.01$) but were not associated with all other aspects of actual nutrient intake and food selection quality.

Reported Food Behaviors and Attitudes toward Health

Regression analyses showed significant relations between constructs related to attitudes toward health and reported food selection and consumption behaviors (Table 4.4). Overall, participants' attitudes toward health were significant predictors of their reported percentage of green-labeled food selections ($r=0.53$; $p<0.001$), frequency of breakfast consumption ($r=0.42$; $p<0.001$), quantity of fried food choices at a meal ($r=0.50$; $P<0.001$), as well as what percentage of their plate was filled with fruits and/or vegetables ($r=0.35$; $p<0.01$). Participants' attitudes toward health, however, were not significant predictors of their SS beverage consumption.

<Insert Table 4.4 Here>

Discussion

A scant amount of research exists regarding the eating behaviors of military diners and to date, such research focused on evaluating the influence nutrition interventions have on soldiers nutrient intakes and overall satisfaction (Crombie et al., 2013; Sproul et al., 2003). No research has attempted to connect soldiers' beliefs, attitudes and nutrition knowledge with the quality of their food choices and food intake. Our study is the first address this gap and also the first to evaluate these relationships with both reported and actual behaviors.

We found using a combination of previously established food intake estimation methods (Ball, Benjamin, & Ward, 2007; Templeton et al., 2005; Williamson et al., 2003) was effective for estimating participants' meal selections and food consumption. Our results related to macronutrients of soldiers' intakes were consistent with previous findings related to military diners' nutrient intakes, which were estimated using digital photographs and computerized plate waste methods (Crombie et al., 2013). Using a combination of methods was also effective for minimizing service disruptions due to researchers present in the dining room. Although digital photography methods have been used previously to estimate food selection and plate waste in foodservice settings (Crombie et al., 2013; Martin et al., 2006; Williamson et al., 2004), we found this method was effective for identifying soldiers' food selections but not adequate for researchers to estimate plate wastes. Our preliminary data analyses were not effective or consistent when estimating food consumed using the photographs. Previous studies used 10% increments for plate wastes, but multiple reviewers in this study could not accurately estimate plate wastes using photographs nor agree observed estimation. Therefore, plate waste methods were employed using digital scales instead of using digital photography methods when determining the amount of plate waste.

As previous studies identified, soldiers' actual selections and nutrient intakes were more closely related to the DFAC lunch meal offerings and less with reported food selection behaviors (Cullen, Watson, & Zakeri, 2008; Ludvigsen & Sharma, 2004; Vecchiarelli, Takayanagi, & Neumann, 2006). Participants reported intakes of healthy items (green-labeled based on *Go for Green* program) being nearly 18% higher than actual selection of green-labeled items. Table 4.5 provides a summary of the total number of red-, yellow-, and green-labeled items offered during lunch in the DFAC on the data collection day. Main line, short order and dessert areas consisted mostly of yellow- and red-labeled items while a majority of green-labeled items were on the

salad and sandwich bars. A majority of condiments, such as salad dressings, were also red-labeled items. While green-labeled items were available, a majority of the main course offerings were red- and yellow-labeled choices, making it increasingly difficult for diners to make healthier food choices, and more conducive for making higher calorie, lower nutrient food choices.

<Insert Table 4.5 Here>

Consistent with previous studies that evaluated the relationship among health-related beliefs and reported diet quality (Deshpande et al., 2009; Sapp & Jensen, 1998; Sapp & Weng, 2007), we found soldiers' attitudes toward health were associated with most self-reported dietary behaviors. Similar associations were also found between nutrition knowledge and self-reported food behaviors, which was also supported by previous studies (Drichoutis, Lazaridis, & Nayga, 2005; Kolodinsky et al., 2007). Regardless of their attitudes toward health, a majority of soldiers (75%) regularly consumed SS beverages. Although we did not measure how much they drank during the meal we observed due to complexity and inability to keep track of refills, a majority of beverage choices soldiers made seemed to be SS beverages. Our results showed similarity to previous studies that evaluated SS beverage consumption trends among both US adults and adolescents (Bleich, Wang, Wang, & Gortmaker, 2009; Weng, Bleich, & Gortmaker, 2008). The percentage of soldiers consuming SS beverages on a regular basis is considerable despite recommendations to consume less.

While soldiers' nutrition knowledge and attitudes toward health influenced their reported behaviors, this was not the case with their actual eating behaviors. We did find, however, a strong association between perceived hunger level and nutrient intake. Soldiers' reporting greater hunger levels consumed more kilocalories, fat, cholesterol and sodium. As demonstrated in previous studies (Almiron-Roig, Grathwohl, Green, & Erker, 2009; Farajian, Katsagani, & Zampelas, 2010; Williams, Noakes, Keogh, Foster, & Clifton, 2006), these results suggest that for this population, decreasing hunger levels prior to meals may improve the quality and quantity of foods consumed. Additionally, this finding, along with previous studies, support the possibility that, while attitudes toward health and nutrition knowledge influence certain food-related behaviors, in this particular setting and with this particular population, other factors, such as hunger, taste, availability and convenience, are more influential on food selection and intake (Glanz et al., 1998; Levi, Chan, & Pence, 2006).

There are two major limitations to this study, mainly due to time and expenses that are required to conduct a more extensive study. First, data collection for this study occurred over the lunch meal period only. Patrons' food selections and nutrient intake in the DFAC may be different at breakfast and dinner. Second, participants' food selections were only assessed on one occasion. Analyzing their selections and intake over several lunch meals may provide a more accurate assessment of their actual intake. Future studies may assess participants' food choices and consumptions over multiple occasions and at different meals for a comprehensive analysis of actual food selection and intake.

Conclusion

This study evaluated factors influencing reported and actual food selection and nutrition intakes of non-training Army DFAC patrons including soldiers' nutrition knowledge and attitudes toward health. The results of the study indicated that while knowledge and attitudes influenced reported nutrition behaviors, only physiological cues, such as hunger, and food availability impacted actual food selection and intake. Furthermore, we found overall soldiers were knowledgeable about nutrition and possessed positive attitudes toward health, however, their nutrient intakes failed to meet the established guidelines. The results of this study provide evidence that for this and other similar populations (young, male, and generally healthy and active), nutrition education only may not result in better food choices when consuming meals in cafeteria settings. Registered dietitians and public health professions can use these results when developing strategies to influence and improve the healthfulness of young populations' dietary behaviors in away from home settings. Extending beyond simply educating and informing consumers about food choices and establishing initiatives that 1) improve the nutrition quality of meal selections, and 2) provide nutritious snacks to control hunger levels before meals, may be a more successful approach to influencing food behaviors.

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Tables and Figures

Table 4.1 Summary of non-training military diners' lunch meal nutrient intakes

Variable	M \pm SD	Range	$\geq 33\%$ MDRI ^a	
			n	%
Kilocalories ^b	886 \pm 326	(248 – 1895)	33	31
Carbohydrates (g)	91 \pm 39	(19 – 218)	-	-
Dietary Fiber (g)	9 \pm 5	(1 – 26)	-	-
Protein ^c (g)	38 \pm 15	(10 – 72)	77	53
Sodium ^d (mg)	1784 \pm 872	(331 – 5479)	32	30
Iron ^e (gm)	6 \pm 3	(2 – 13)	82	57
Vitamin C ^f (mg)	45 \pm 44	(0 – 180)	48	33
Vitamin A ^g (IU)	2430 \pm 3156	(86 – 15731)	19	13
Cholesterol ^h (mg)	133 \pm 68	(0 – 339)	66	62
Total Fat ⁱ (g)	39 \pm 18	(2 – 109)	-	-
Saturated Fat ^j (g)	11 \pm 6	(0 – 34)	-	-

Note. MDRI = Military Dietary Reference Intakes

^{a-j} Nutrient intake standards extracted from Army Regulation 40-25, “Nutrition Standards and Education” by Headquarters, Departments of the Army, Navy, and Air Force, 2001.

^{b-g} Values for energy, protein, and associated nutrients are expressed as average daily nutrient intakes and based on moderate activity levels and reference body weight of 79 kg (174 lb) for military men and 62 kg (136 lb) for military women.

ⁱ Recommended total fat intake for military populations is $\leq 30\%$ total calories.

^j Recommended total saturated fat intake for military populations is $\leq 10\%$ total calories.

Table 4.2 Frequencies and percentages of non-training soldiers' endorsed items for attitudes toward health

Construct	Endorsement	
	n	%
Perception of current diet	97	71
Perceived benefits to eating a healthy diet		
<i>Maintain health body weight</i>	131	95
<i>Improve overall health</i>	131	94
<i>Improve physical performance</i>	127	92
<i>Decrease body fat percentage</i>	120	87
Perceived barriers to eating a healthy diet		
<i>Healthy food is less convenient</i>	67	49
<i>Others around me make unhealthy food choices</i>	55	40
<i>Healthy food is unavailable in the dining facility</i>	51	37
<i>Healthy food is unaffordable</i>	42	31
<i>I lack enough nutrition knowledge to make healthy food choices</i>	27	20
<i>I don't desire to eat healthy food</i>	21	15
Perceived importance of eating a healthy diet		
<i>Contains a variety of foods</i>	107	79
<i>High in fruits and vegetables</i>	103	75
<i>High in fiber</i>	97	71
<i>Low in cholesterol</i>	93	69
<i>Low in saturated fat</i>	90	67
<i>Low in sugar</i>	89	65
<i>Low in total fat</i>	87	64
<i>Low or moderate in salt or sodium</i>	80	59
<i>Lower in calories</i>	79	58

Table 4.2 Frequencies and percentages of non-training soldiers' endorsed items for attitudes toward health (cont.)

Construct	Endorsement	
	n	%
Cues to action		
<i>Identified or labeled as healthy</i>	77	55
<i>Recommended by a family member</i>	72	52
<i>Recommended by a healthcare professional</i>	70	51
<i>Recommended by a friend or colleague</i>	66	48
<i>Recommended by a work supervisor</i>	57	41

Table 4.3 Correlations and significance between non-training diners' perceived hunger levels and primary outcome variables

Nutrients	Correlation Coefficient	<i>p</i> value
Kilocalories	-.25	.01
Protein (g)	-.32	.001
Carbohydrates (g)	-.08	.41
Total Fat (g)	-.29	.002
Saturated Fat (g)	-.32	.001
Cholesterol (mg)	-.27	.006
Sodium (mg)	-.35	<.001
Dietary Fiber (g)	-.09	.38
Iron (mg)	-.14	.15
Vitamin A (IU)	-.05	.60
Vitamin C (mg)	-.01	.96
Green-labeled selections (%)	-.15	.14

Table 4.4 Multiple regression analysis predicting non-training diners' reported food behaviors from attitudes toward health

Variables	Reported Food Behaviors							
	Green Labeled Choices		Breakfast Frequency		FF Intake		F/V Intake	
	β	95% CI	β	95% CI	β	95% CI	β	95% CI
Constant	-0.24	[-0.50, 0.02]	1.62**	[0.50, 2.73]	2.10**	[1.39, 2.81]	1.50**	[0.64, 2.36]
Perceived Adequacy of Current Diet	0.16**	[0.10, 0.21]	0.25*	[0.01, 0.50]	0.39**	[0.23, 0.54]	0.21*	[0.02, 0.41]
Perceived Benefits	0.05	[0.00, 0.10]	0.24*	[0.02, 0.46]	0.14	[-0.01, 0.27]	0.03	[-0.14, 0.20]
Perceived Barriers	-0.01	[-0.03, 0.01]	-0.02	[-0.12, 0.09]	-0.05	[-0.11, 0.02]	-0.08*	[-0.16, 0.00]
Importance of Healthy Diet	0.01	[0.00, 0.03]	0.06	[-0.01, 0.13]	-0.01	[-0.05, 0.04]	0.07**	[0.02, 0.12]
Cues to Action	-0.01	[-0.03, 0.02]	0.06	[-0.04, 0.16]	0.04	[-0.02, 0.10]	-0.08*	[-0.15, 0.00]
R^2	.28		.18		.25		.12	
F	9.19		5.23		7.97		3.33	

Note. FF = fried food.
F/V = fruit and vegetable.
CI = confidence interval.

* $p < .05$.

** $p < .01$

Table 4.5 Summary of non-trainee DFAC meal offerings based on *Go for Green* labeling criteria

Meal Category	Red Items	Yellow Items	Green Items
Entrée	1	1	0
Side Dishes	4	1	3
Salad Bar	7	4	13
Sandwich Bar	2	2	9
Short Order	5	3	0
Desserts	4	1	1
Miscellaneous	4	4	6
Percent Totals^a	36%	21%	43%

Note. ^aCalculated based on total number of meal items offered (n = 75).

Chapter 5 - Effectiveness of Healthy Menu Changes in a Non-Trainee Military Dining Facility

Abstract

The purpose of this study was to evaluate the impact of implementing the Initial Military Training (IMT) menu standards in non-trainee dining facilities (DFAC) on food selection, nutrient intake, and satisfaction of soldiers. Participants were recruited during lunch periods before and three weeks after the menu standard changes. Direct observations, digital photography, and plate waste methods were used to assess soldiers' food selection and consumption, along with a survey assessing soldiers' satisfaction with meals served under two menu standards. Food selection and consumption were evaluated using the Army's *Go for Green* Nutrition Labeling Program and the Military Dietary Reference Intakes (MDRI). Descriptive statistics and independent sample t-tests were used to summarize and compare the data. A total of 172 and 140 soldiers participated before and after menu changes, respectively. Soldiers consumed 886 kcals (38.6% from total fat and 11.2% from saturated fat) and 1784 mg of sodium before the menu change. Three weeks after the change, all figures improved (705 kcals, 31% of kcals from total and 9% from saturated fat, and 1339 mg of sodium) ($p < 0.01$). The percentage of healthier food selections mirrored food items served at the DFAC and improved after the intervention ($p < 0.001$). There were no differences observed in overall satisfaction and meal acceptability after the intervention, and "food appeal" ratings actually improved. Our findings suggest implementing the IMT menu standards in non-trainee Army DFACs is feasible and has the potential to improve the overall healthfulness of soldiers' food selection and consumption.

Introduction

Obesity continues to be a serious health problem in the United States (U.S.) and is linked to several co-morbidities, rising healthcare costs and over 100,000 preventable deaths each year (Guh et al., 2009; Finkelstein, Trogdon, Cohen, & Dietz, 2009; Flegal, Graubard, Williamson, & Gail, 2005). In 2010, 35.7% of adults, and 16.9% of children and adolescents were considered obese (Ogden & Carroll, 2010), and in 2012, 13 states reported obesity prevalence of 30-35% (Centers for Disease Control and Prevention [CDC], 2012).

The nation's obesity problem has negatively impacted the U.S. military, jeopardizing the strength of our nation's defense. From 1995-2008, obesity rates among service members increased from 5% to 13% (Bray et al., 2009). Rising obesity rates among current and potential service members have attributed to higher attrition rates and weight control program enrollments as well as an overall decrease in the number of the potential military recruits (Bedno et al., 2010; Hus, Remington, Tobler, & Rubertone, 2007; Packnett, Niebuhr, Bedno, & Cowan, 2011).

In an effort to address the influx of weight-related problems occurring within military populations, several nutrition programs have been developed for use in military dining facilities (DFACs). DFACs have become ideal locations for such programs because of the large number of service members consuming one or more meals in these facilities each day (Bray et al., 2009). A majority of nutrition programs, such a point-of-purchase and color-coded nutrition labeling systems, have focused on helping patrons make informed meal selections. Research evaluating these programs is limited; however, similar studies evaluating the effectiveness of comparable interventions in university and worksite cafeterias (Hoefkens, Lachat, Kolsteren, Van Camp, & Verbeke, 2011; Vyth et al., 2011) found that these programs failed to influence the healthfulness of diners' meal selections. Researchers also found using point-of-purchase calorie labels in Army DFACs had no influence on soldiers' meal selections (Sproul, Canter and Schmidt, 2003). In contrast, Crombie et al. (2013) observed improvements in nutrient intakes after improving the nutrition quality of select menu items in addition to implementing a color-coded nutrition labeling system.

In 2010, the Army implemented the Soldier Fueling Initiative (SFI), a program developed to help improve the nutrition and weight status of soldiers in their initial military trainings (U.S. Army Food Program, 2012). The main component of the SFI is the Initial Military Training (IMT) menu standards, which were implemented in Army DFACs serving initial training soldiers. These prescribed menu standards, including standardized menus, recipes, and preparation methods, maximize lower-calorie, nutrient dense selections and minimize poor nutrition choices available at each meal. Currently, only IMT DFACs use the IMT menu standards while all other DFACs follow less rigid menu standards (Headquarters Department of the Army, 2012).

Because of its initial success with improving the overall health status and physical performance within the IMT soldiers (Kappler, 2011), the IMT menu standards may potentially be implemented in all DFACs. While this change could provide nutritional benefits to all soldiers, it is unknown if this change would positively impact the nutrition quality of diners in non-trainee DFACs. Additionally, the difference in training versus non-training diners must also be addressed. IMT soldiers are captive audiences and are required to consume all of their meals in the DFAC, while non-IMT soldiers dine in DFACs voluntarily. For non-trainee DFACs, meal selections can have a significant impact on DFAC utilization if diners are not satisfied with meal choices (Namkung & Jang, 2007; Ruy, Han, & Kim, 2008). Therefore, the purpose of this study was to evaluate the impact of implementing the IMT menu standards in non-trainee DFAC on food selection, nutrient intake, and satisfaction of soldiers. Based on the results of this investigation, authors aimed to determine feasibility of implementing IMT menu standards in a non-trainee DFACs.

Methods

Subjects

The target population of this study was soldiers in a non-training status who dine regularly in Army DFACs. The location for the research was a large DFAC on a large Army installation in the Midwestern region of the U.S. Although only one location was chosen, soldiers on this Army installation are considered a good representative sample of the target population because they are soldiers from all areas of the U.S. who are not in

training. Participants were recruited during two weekday lunch meal periods and were first notified of the study a week prior to each data collection day using flyers and posters placed in highly visible locations within the DFAC. On each selected data collection day, which was chosen because of their projected high census, participants were recruited at each of the two main entrances to the DFAC throughout the 90-minute meal period. Each soldier who is interested in participating in the study was provided a consent form and a laminated card with brief instructions on one side and a place for them to write a personalized four-digit code on the other. Soldiers not planning to eat their meals in the DFAC (e.g., utilizing the take-out option), diners other than service members (e.g., Department of the Army civilian employees, civilian family members), and DFAC staff members were excluded from participating in the study. The study was approved by the Institutional Review Boards of a university and Madigan Army Medical Center, Fort Lewis, WA.

Instrument and Study Protocol Development

Two components for data collection were developed for this study. The first component involved methods used to determine food selection and consumption and the second component was a survey instrument to assess demographic variables, overall customer satisfaction and meal acceptability.

Food Selection and Consumption

For this study, various food intake estimation methods were used to determine participants' food selection and intake. Digital photography methods, which have been used previously in food service settings to estimate intake (Crombie et al., 2013; Williamson et al., 2003, 2004), were used to estimate participants' food selections, direct observation methods (Ball, Benjamin, & Ward, 2007; Gittelsohn, Pokhrel, Shankar, & West, 1994) were used to determine selection of self-service items, and plate waste methods (Adams, Pellether, Zive, & Sallis, 2005; Templeton, Marlette, & Panemangalore, 2005) were used to estimate leftover food quantities. Even though previous studies (Crombie et al., 2013; Williamson et al., 2003, 2004) used digital photography methods to estimate the amount of food consumed, preliminary data collection and analyses failed to show reliability of the data collected.

Food selection was estimated by photographing participants' food trays at one of two identical digital photography stations after food and beverage selections were made. Each photograph station was equipped with a digital camera (e.g., Nikon D3100) positioned on a tripod and set at a 45-degree angle approximately 20" above the food. Tray mats were used for tray placement, and rulers were placed horizontally and vertically next to each tray as photograph reference points. Research assistants located at each self-service area (e.g., salad bar) observed participants' food selections and annotated tray numbers and recorded the type and amount of each food item selected on an observation form. Data collected from observations were used to assist with assessing participants' food selections and amount of food served.

In order to estimate plate waste, participants placed their food tray and tray card on the dishroom tray return after meal consumption. Once trays reached the dishroom, research assistants collected them from the tray return and photographed trays with leftover food items before weighing each food to the nearest gram using a calibrated digital scale. Food item weights and tray numbers were annotated on a plate-waste sheet and used for analysis.

The nutrition quality of participants' food selections was determined using the Army's *Go for Green* nutrition labeling system (U.S. Army Food Service, 2012), a program implemented in all Army-operated DFACs that encourages patrons to make nutritious food choices for improved performance and health. The *Go for Green* program establishes a color code system based on a food or beverage's total calories and nutrient content. Items high in calories, sugar and/or fat, and low in nutrients are labeled red and items labeled yellow are moderate in calories, sugar and/or fat, and nutrients. Items with green labels are considered optimal choices and are lower in calories, total fat and/or sugar, and highest in nutrients.

Food consumption was determined by taking the food's reference portion minus weights of plate waste. The reference portion size for each item was established prior to the start of the lunch meal by the mean weight of 10 typical portions served by foodservice personnel. For self-service items, such as salad bars, research assistants established reference portion sizes using utensils provided. Weights of 10 portions for

each item were determined using a calibrated digital scale, and the mean weight of each food item was calculated and later used for analysis.

For nutrient intakes analyses, total kilocalories, the amounts of total fat, saturated fat, dietary cholesterol, protein, total carbohydrates, dietary fiber, iron, vitamin A, vitamin C, and sodium were calculated. Nutrients for individual food items served were determined based on standardized recipes and the reference portion sizes (not the portion sizes indicated on the standardized recipes because of discrepancies between standardized recipes and actual amount served) using the United States Department of Agriculture (USDA) Nutrient Database for Standard Reference, release 26 (USDA Agricultural Research Service, 2013).

Food intake and consumption methods were piloted tested with 50 patrons during lunch at the selected DFAC one menu cycle prior to the data collection day. All noted improvements and suggested changes were made to the established methods prior to data collection.

Customer Satisfaction and Meal Acceptability Assessment

For this study, a 24-item survey was developed to assess participants' demographic characteristics and key variables of interest. Nine demographic questions were asked including age, rank, years of military service completed, gender, current height and weight, meal card status, active duty weight control program enrollment, and education level. Six and nine items were used to evaluate service and food quality, respectively. All items were measured using a five-point Likert scale.

A panel of military and university foodservice experts and researchers reviewed the survey instrument for face validity and clarity of directions and provided feedback for revisions. The final survey was pilot tested during lunch at another DFAC on the Army installation with 30 soldiers one month prior to the first data collection day.

The Intervention

The researchers altered the selected DFAC's current menu and meal offerings to ensure food items offered during the three-week intervention were consistent with the IMT menu standards. DFAC facility managers were provided a 21-day IMT mainline, short order and dessert menu, as well as a list of standard offerings for salad bar and

everyday items two months prior to implementation. Staff members were trained and educated on the IMT menu standards, and appropriate substitutions were made to meal offerings and menus if items could not be ordered or recipes that could not be prepared. The Army *Go for Green* Food Labeling System, a component of the IMT menu standards, was already established at the selected DFAC and was continued through the implementation period. A summary of the major changes made in the DFAC during the IMT implementation is illustrated in figure 5.1.

<Insert Figure 5.1 Here>

Data Collection

For this study, data collection occurred in the selected DFAC once during the baseline period, when the current menu standards were in place, and again at the conclusion of a three-week implementation of the IMT menu standards. On each selected data collection day, eligible soldiers who were interested in participating in the study were provided a brief explanation of the study and a blank, brightly colored laminated tray card with instructions on the back. Participants were asked to write a self-created, four-digit code on the front of their laminated card and place it number-side up on their tray. After leaving the recruitment area, participants made their food and beverage selections and proceeded to one of two digital photography stations set up near the main seating areas. At the photography station, research assistants provided participants with a consent form and survey and took pictures of trays. A self-created four-digit code was also used on the survey, and soldiers filled out the questionnaire while eating their meal. After completing their meal, soldiers were asked to leave the laminated card on the their tray which was placed on the tray return. Before leaving the building, research assistants collected completed surveys and signed consent forms. Those that completed the study were offered a small token of appreciation (e.g., keychain flashlight). Trays that were returned to the dishroom were photographed, and plate wastes were weighed using the protocol explained earlier. Based on the reference portion sizes and plate waste, amounts of food consumed were determined.

Statistical Analysis

Nutrient Quality

The two outcome variables for this study measuring soldiers' nutrition quality: food selection quality and nutrient intake. Food selection quality was defined as the percentage of green-labeled food items selected and calculated using the following equation:

$\text{Food selection} = \text{total number of green items selected} \div \text{total number of items selected}$
--

Nutrient intake was defined as 1) the actual energy, macro and micronutrients consumed, and 2) as a percentage of the established macronutrient meal guidelines, when applicable, outlined in Army Regulation (AR) 40-25, *Nutrition Standards and Education* (Headquarters Departments of the Army, Navy and Air Force, 2001). For statistical analysis, comparisons were made between the groups' actual nutrient intakes and the established nutrition guidelines.

The primary independent variables were customer satisfaction and menu acceptability. Customer satisfaction was defined as the mean response to the six items related to service quality and meal acceptability was defined as the mean response to the nine items related to meal quality.

All analyses were performed using IBM SPSS software (version 21.0, IBM Corporation) with an α value set at 0.05 for statistical significance. Descriptive statistics were used to summarize the participants' demographic characteristics and survey responses. Independent samples t-tests were conducted to evaluate differences in food selection, nutrient intake, customer satisfaction and meal acceptability.

Results

A total of 332 soldiers expressed interest in participating in the study: 172 during the baseline data collection day and 160 three weeks after the intervention. Of those recruited for baseline, 154 surveys were returned and 135 matched photographs were obtained. During the intervention data collection, 131 surveys were returned and 124 matched photographs were attained.

No significant differences were observed in the demographic characteristics between the baseline and intervention groups. Similar to previous studies conducted on

military populations in foodservice settings (Crombie et al., 2013; Sproul et al., 2003), most participants were male (93 before and 96% after the intervention), 25 years of age (mean age 25.4 vs. 24.9), had a BMI of 26.3 (mean BMI 25.9 vs. 26.6), were at the rank of E-4 or below (80 vs. 72%) with less than four years of service (79 vs. 70%) and possessed a high school diploma/GED (68 vs. 63%). Also, a majority of participants were meal card holders (80 vs. 70%) not enrolled in the active duty weight control program (96 vs. 96%).

Differences in food selection and nutrient intake between the baseline and intervention groups are found in table 5.1. Several differences were identified in food selection and intakes before and after the intervention. On average, both groups selected the same number of items for their meal (6.5 vs. 6.8); however, the percentage of red-labeled items selected was significantly lower and green-labeled items significantly higher after the intervention compared to baseline (45 vs. 18% and 36 vs. 58%, respectively). The DFAC meal offerings were also significantly different from baseline to intervention, with 39% offerings being red-labeled and 41% green-labeled at baseline and 17% red-labeled and 61% green-labeled during the intervention. Table 5.2 provides a summary of the meal offerings on each data collection day.

<Insert Table 5.1 Here>

<Insert Table 5.2 Here>

Soldiers' total energy intakes in the intervention group were significantly lower (886 vs. 705 kilocalories), with less kilocalories coming from total fat (38 vs. 31%) and saturated fat (11 vs. 9%), and a greater percentage coming from carbohydrates (42 vs. 45%) and protein (18 vs. 15%). Sodium intakes were also significantly lower (1784 vs. 1339 mg), as were intakes of vitamin C (45 vs. 31 mg). No differences in intakes were observed between the two groups for total cholesterol, iron, fiber and Vitamin A.

Table 5.3 presents a summary of the results comparing baseline and after the intervention responses to service and food quality survey items. Higher scores represent a greater level of agreement with specific topics addressed in survey items. Soldiers' overall service quality rating at baseline and after the intervention remained unchanged, with mean scores being 3.6 and 3.6, respectively. Ratings for mean overall food quality

were similar (3.5 vs. 3.6). Differences in individual survey items were not significant with the exception of food appeal, which was slightly higher after the intervention ($p < 0.05$).

<Insert Table 5.3 Here>

Discussion

A very limited research exists regarding the effectiveness of nutrition strategies and interventions in military DFACs. To date, only two studies have focused on this area of research (Crombie et al., 2013; Sproul et al., 2003) and no studies have been published evaluating the IMT Menu Standards Initiative. Our study not only contributes to an important and highly under-researched area, but is also the first to evaluate the effectiveness of these menu standards on the food selection and nutrient intakes of soldiers' in a non-training status, and to address the feasibility of implementing these standards in a non-training environment.

We found that healthy menu standard changes had a significant impact on soldiers' food selection and nutrient intake. Implementing the IMT menu standards involved several changes to the current meal offerings and food preparation methods, which resulted in a greater selection of lower-calorie, higher nutrient food choices and a decreased number of high-energy, low nutrition quality selections. As with previous studies evaluating meal choices in foodservice settings (Cullen, Watson, & Zakeri, 2008; Hoefkens et al., 2011), food selections available to patrons significantly influenced actual food selections. At baseline, nearly 40% items offered were red labeled and 45% of patrons actual selections were red-labeled items; following the intervention, over 60% of available food choices offered were green labeled and patrons' actual meal selections comprised of nearly 60% green-labeled items. Changes to menu standards also resulted in a significant decline in soldiers' intakes of kilocalories, total fat, saturated fat, and sodium. Percentage of calories from fat was only slightly above established meal recommendations of $\leq 30\%$ and saturated fat intake met recommendations of $\leq 10\%$. Despite its emphasis on increased offerings of whole grain items and fruits/vegetables and decreased amount of cholesterol, the IMT menu standards did not have a significant

impact on dietary fiber and cholesterol, and vitamin C intake significantly decreased after the intervention. Dietary fiber remained unchanged, and even though total carbohydrates decreased after the intervention, only 10% of the total carbohydrates were comprised of dietary fiber in both groups. Total cholesterol intakes for both groups were similar and exceeded one-third of the daily recommendation of 300 mg. Although the IMT menu standards required lower-fat cooking methods and recipe ingredients, meat entrees and salad bar toppings such as shredded cheese and chopped egg were still offered, all of which were popular among both baseline and intervention groups. Lower intakes of vitamin C may have resulted due to main line vegetable choices, which were higher in vitamin C content on the baseline data collection day compared to those offered on the intervention data collection day. It is unlikely salad bar offerings influenced vitamin C intake since all selections, with the exception of prepared salads, salad dressings and bacon bits, remained unchanged throughout both baseline and intervention periods.

In addition to observing an improvement in the nutrition quality of food selections and intake, we also found that changes made to menu standards over a period of three weeks did not impact participants' satisfaction with service and meal quality and overall scores remained high. These findings are consistent with previous studies conducted in military DFACs (Crombie et al., 2013) and non-military foodservice environments (Kim, Ng, & Kim, 2009; Kimathi, Gregoire, Dowling, & Stone, 2009) that also found improving the healthfulness of meal options had a positive influence on customer satisfaction. Participants not only remained satisfied with food quality, but also found the IMT menu choices to be more appealing than those offered during baseline. These findings are a clear indication that the changes made to the current menu standards are accepted by diners and may even be preferred.

There are several limitations to this study. First, it is possible that participants may have altered their typical food selections due to the presence of researchers and not because of the menu standard changes. Second, although the IMT menu standards were also implemented at dinner meals, data collection for this study occurred over the lunch meal period only. Patrons' food selections and nutrient intake in the DFAC may be different at the dinner meal. Due to time and financial constraints, the IMT menu was only implemented for a period of three weeks in one DFAC and participants' food

selections were only assessed on one occasion. Analyzing selections and intake over several lunch meals may provide a more accurate assessment of their actual intake. Also, a longer implementation period may have yielded different results. Future studies may want to implement IMT menu standards for a longer period of time and assess patrons' choices on more than one occasion for a more comprehensive analysis of food selection and intake.

Due to the logistical challenges associated with changing beverage options for only a short period of time and the DFAC management staff's concern with the potential negative impact on customer satisfaction, beverage choices were not changed to meet IMT standards. In addition, DFAC management staff was also concerned about changing breakfast items to meet the IMT menu standards as they expected negative consequences on DFAC census. Therefore, only lunch and dinner food choices were modified to comply with IMT menu standards. Full implementation of IMT menu standards at all meals would reveal true impact of these changes. Future studies may explore full implementation of IMT menu standards, keeping in mind that these non-training soldiers have other options for their meals. If DFAC utilization rates fall below unsustainable levels, the effectiveness of such intervention will be minimized and more DFACs may face the challenge of closure.

Although beverage consumption has a large impact on total nutrient intake, due to the complexity of data collection in an "all-you-can-eat" DFAC where soldiers are allowed to continue refilling their beverages, this study did not address nutrient quality related to beverage consumption. Future studies may include beverage consumption, types and amount of beverages consumed, to more accurately assess nutrient intakes of non-training soldiers.

Conclusion

This study assessed the impact of the IMT menu standards on non-training soldiers' food selection and nutrient intake, as well as their overall dining satisfaction and meal acceptability. The results of the study indicated the IMT menu standards improved the nutrition quality of soldiers' food selections and decreased intakes of kilocalories,

total fat, saturated fat and sodium. Furthermore, we found the overall high ratings of service and food quality remained unchanged after the intervention and soldiers' found the IMT menu selections more appealing. The results of this study provide evidence the IMT menu standards have a significant influence on the nutrition quality of patrons' meals, are accepted by soldiers' in a non-training status and can feasibly be implemented in DFACs servicing the population studied. Military dining and nutrition services leaders as well as registered dietitians and public health professions can use these results when developing and implementing strategies to improve the healthfulness of diners' meals in away from home settings.

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Tables and Figures

Figure 5.1 Summary of changes made to the selected DFAC during the IMT menu standards implementation period

Mainline:

- At least two main entrees offered (at least one being non-pork); fish served at least three times per week; only lean ground beef and turkey (fat content no more than 10%) used in recipes; all entrees prepared using low-fat methods (no frying) and served without added fat
- Gravies or sauces served on the side whenever possible
- All potato and starch choices prepared using low-fat methods (no frying); pastas either multigrain or nutrient enriched; at least one or all starch/pasta/rice options were not prepared or served in a cream sauce
- All meals included at least two hot vegetables, with no more than one being a starchy vegetable
- Beans and legumes were served at least three times per week

Every day items (offered at every meal):

- One cream or broth-based reduced sodium soup
- At least two choices of fresh fruit
- At least three bread types (whole grain/whole wheat only) along with one selection of hot bread (e.g., hot rolls)
- Trans fat free (zero grams trans fat per serving) spread, jelly/jam, and peanut butter
- At least two flavors of low fat individual yogurt
- Baked potato chips and/or pretzels only

Desserts (four different choices offered daily):

- Four days a week all dessert choices were lower in fat
- Three days a week two choices were regular desserts and two were low-fat

Short Order (offered no more than four times per week):

- Meat patties for grilled hamburgers and cheeseburger no more than 15% fat
- Grilled cheese made with whole grain bread
- All specialty sandwiches grilled using nonstick cooking spray
- Link-type meats (e.g., frankfurters) were not served
- All side items (e.g., French Fries) prepared using low-fat cooking methods (no frying)
- Two hot vegetables (at least one non-starchy) included as part of the short order menu

Deli Bar (offered daily):

- At least three lean deli meat and whole grain/whole wheat bread choices; two sliced cheese choices (no imitation), a variety of fresh vegetables, mustard and mayonnaise

Salad Bar (offered daily):

- Leafy green salad made with green leafy vegetables and hard vegetables (e.g., carrots) along with at least 10 different toppings
- Five different salad dressings (at least three low-fat); oil and vinegar offered
- All mayonnaise-based salads made with low-fat mayonnaise or salad dressing

“Go for Green” Labeling:

- All food items were properly labeled for each meal service

Table 5.1 Difference in nutrient intake before and after implementation of the IMT menu standards

	Baseline (n =136)	Intervention (n = 124)	95% CI			
Variable	M±SD	M±SD	<i>t</i>	<i>p</i>	<i>LL</i>	<i>UL</i>
Kilocalories	886±326	705±226	5.26	<.001	113.5	249.5
Carbohydrate (g)	91±39	79±29	2.92	.004	4.04	20.86
Carbohydrate (%)	42±10	45±13	-2.41	.02	-0.06	-0.01
Protein (g)	38±15	42±12	-1.96	.05	-6.60	0.02
Protein (%)	18±6	25±8	-8.30	<.001	-0.09	-0.05
Total Fat (g)	39±19	25±15	6.38	<.001	9.24	17.50
Total Fat (%)	38±19	31±10	6.11	<.001	0.05	0.10
Cholesterol (mg)	133±68	133±85	0.01	1.00	-18.65	18.78
Sodium (mg)	1784±872	1339±650	4.70	<.001	258.9	632.7
Dietary Fiber (g)	9±5	8±3	1.10	.28	-0.47	1.61
Iron (mg)	6±3	5±2	1.92	.06	-0.01	1.21
Vitamin C (mg)	45±44	31±31	2.93	.004	4.53	23.15
Vitamin A (IU)	2430±3156	1887±2377	1.58	.12	-135.6	1222.0
Saturated Fat (g)	11±6	7±5	4.93	<.001	2.08	4.85
Saturated Fat (%)	11±5	9±4	3.25	.001	0.01	0.03
Red Items (%)	45±23	18±14	11.84	<.001	0.23	0.32
Yellow Items (%)	19±17	25±13	-3.18	.001	-0.10	-0.02
Green Items (%)	36±24	58±19	-8.26	<.001	-0.27	-0.17

Table 5.2 Summary of non-trainee DFAC meal offerings based on *Go for Green* labeling criteria before and after three-week IMT implementation period

	Baseline			Intervention		
	Red	Yellow	Green	Red	Yellow	Green
Meal Category						
Entrée	1	1	0	0	1	2
Side Dishes	4	1	3	2	4	6
Salad Bar	7	4	13	3	2	15
Sandwich Bar	2	2	9	2	1	9
Short Order	5	3	0	2	3	3
Desserts	4	1	1	0	2	3
Miscellaneous	4	4	6	3	4	11
Percent Totals^a	36%	21%	43%	15%	22%	63%

Note. ^aCalculated based on total number of meal items offered at baseline (n = 75) and after the intervention (n = 78).

Table 5.3 Summary of mean differences in satisfaction scores for baseline and intervention menu groups

Variable	Baseline (n = 136)	Intervention (n = 124)
	M±SD	M±SD
Friendliness of Staff	4.1±0.9	4.2±0.8
Food Order Accuracy	4.2±0.9	4.1±0.9
Promptness of Service	4.2±0.8	4.1±0.9
Timeliness of Food Delivery	4.2±0.8	4.1±1.0
Accommodation of Special Requests	3.7±1.3	3.45±1.4
Overall Service	4.0±0.9	3.9±1.0
Food Freshness	3.8±1.1	3.8±1.1
Food Appeal*	3.6±1.1	3.8±1.0
Food Flavor	3.7±1.0	3.8±1.1
Food Temperature	3.9±0.9	4.0±0.9
Food Accessibility	4.0±0.9	4.0±1.0
Food Variety	3.2±1.3	3.3±1.3
Portion Sizes Served	3.7±1.1	3.7±1.2
Quantity of Healthy Choice Items	3.6±1.1	3.8±1.1
Return Intentions	3.9±1.0	3.9±1.1

Note. * $p < .05$

Chapter 6 - Summary and Conclusions

The purpose of this study was to assess non-training soldiers' food choices and consumption and their satisfaction with current and initial military training (IMT) menu standards through a quantitative survey and analysis of food selection and consumption. This chapter summarizes the major findings; discusses implications for military leadership, researchers, and healthcare professionals; and concludes with limitations and opportunities for future research.

To accomplish the stated purpose of this study, a combination of digital photography, direct observation, and plate waste measurement methods were used to assess food selection and plate waste under both meal conditions. Reported food behaviors, nutrition knowledge, attitudes toward health, perceived quality of food and services in the dining facility (DFAC), and demographic information were collected using a quantitative survey. Food selection, nutrient intake and perceived quality of food and services in the DFAC were compared between the two days with different menu groups. Reported and actual food behaviors were evaluated based on attitudes toward health, nutrition knowledge, and demographic factors.

The research objectives and hypotheses were developed to understand the influences of menu standards, beliefs and attitudes on soldiers' food behaviors. The first objective was to assess soldiers' satisfaction with and acceptability of the current garrison menu standards using a survey. The second objective was to determine soldiers' food selections, and food and nutrient consumption before implementing the IMT menu standards. The third objective was to reassess soldiers' satisfaction, and food selection and consumption of the IMT menu standards after three weeks of IMT menu implementation. The fourth objective was to evaluate the relationships between reported food behaviors, and actual food selection and consumption based on soldiers' demographic characteristics, nutrition knowledge, and attitudes toward health. The last objective was to analyze results before and after implementation of the IMT menu standards, and make recommendations for Army nutrition and food services.

The first three objectives were addressed through implementation of the IMT menu standards for a period of three weeks. Comparisons were made for food selections,

nutrient intake and soldiers' overall satisfaction with the meal selections before and three weeks after implementing IMT menu standards. The relationships between and among soldiers' attitudes toward health, their nutrition knowledge, demographic characteristics, and reported and observed food behaviors were determined under the current menu conditions to address the fourth objective. All results were analyzed and will be used to assist Army leaders with developing nutrition-related initiatives within the military foodservice environment.

Two major data collection protocols were developed for this study: 1) a data collection procedure using a combination of digital photography, direct observation and plate waste methods in order to assess food selection and plate waste, and 2) a quantitative survey instrument to assess variables of interest. Data collection procedures for assessing food selection and intake were established using previous literature related to food intake estimation methods (Adams, Pellether, Zive, & Sallis, 2005; Ball, Benjamin, & Ward, 2007; Gittelsohn, Pokhrel, Shankar, & West, 1994; Templeton, Marlette, & Panemangalore, 2005; Williamson et al., 2003, 2004) and direct observations of DFAC meal service operations. Data collection protocols were pilot tested using 50 soldiers one menu cycle prior to the baseline data collection day at the selected DFAC. The survey instrument was developed using previous literature related to the Health Belief Model (HBM) (Sapp & Jensen, 1998) and customer satisfaction and return intentions (Namkung & Jang, 2007; Ruy, Han, & Kim, 2008), and input from an expert panel of Army Dietitians. It was reviewed by a panel of military and university foodservice managers and researchers before being piloted tested with 30 soldiers at a Ft. Riley DFAC one month prior to data collection. The survey included two questions asking participants to rate hunger and satiety levels before and after the meal, and five questions related to typical food behaviors. A total of 25 items were used to evaluate attitudes toward eating a healthy diet and ten questions were included to assess nutrition knowledge. There were also nine items included to capture basic demographic information.

The target population for this study was military service members in a non-training status who dine regularly at a non-trainee DFAC. The study sample included military patrons dining during lunch services on the selected data collection days at a

DFAC on Ft. Riley, Kansas. Collectively, a total of 332 soldiers expressed interest in participating, and of those, 154 and 131 returned surveys and 135 and 124 matched photographs were obtained on the baseline and intervention data collection days, respectively.

Summary of Major Findings

In this section, major findings from this study with brief methodology are summarized in relation to objectives of the study. Overall, all objectives of the study were accomplished.

Objective 1: Assess soldiers' satisfaction with and acceptability of the current garrison menu standards using a survey.

Baseline group participants' overall rating of service quality was favorable based on a 5-point Likert-scale (neutral = 3.0; strongly agree = 5.0; strongly disagree = 1.0) (4.0 ± 0.9), and the average rating for all items related to service quality was also above neutral (3.7 ± 1.2). Soldiers' return intentions (3.9 ± 1.0) and average food quality rating (3.5 ± 1.2) mirrored perceptions of service quality. These results indicated that soldiers' overall are satisfied with service and are accepting of current menu standard meal offerings.

Objective 2: Determine soldiers' food selections, and food and nutrient consumption before implementing the IMT menu standards.

A total of 135 trays were assessed to determine food selection, plate waste and nutrient intake before implementing IMT menu standards (garrison menu standards). The nutrition quality of meal selections was determined using the Army's *Go for Green* nutrition labeling system (U.S. Army Food Service, 2012). In addition, nutrient intakes were determined based on the amount of food consumed, which was defined as weight of the reference portion size minus the weight of plate waste. When applicable, nutrient intakes were compared to 33% of established military dietary reference intakes (MDRI) and standardized meal guidelines (Headquarters Departments of the Army, Navy and Air Force, 2001).

Participants' mean food selection patterns were similar to the DFAC's lunch menu offering during baseline. Of the seventy-five lunch menu items offered, 38% were

labeled red, 41% labeled green, and 20% labeled yellow. The greatest percentage of selected items was labeled red ($45\% \pm 23\%$), followed by green ($36\% \pm 24\%$) and yellow-labeled items ($19\% \pm 17\%$).

The mean energy intakes at baseline were 886 ($SD = 326$) kilocalories and of this, 38% ($SD = 10$) was from total fat and 11% ($SD = 5$) from saturated fat. The percentage of carbohydrates (net) and protein was 42% ($SD = 10$) and 18% ($SD = 6$), respectively. The average sodium intake was 1784 mg ($SD = 872$), dietary fiber 9 g ($SD = 5$), iron 6 mg ($SD = 3$), cholesterol 133 mg ($SD = 68$), and vitamins A and C were 2462 IU ($SD = 3156$) and 45 mg ($SD = 44$), respectively. The mean percentages total fat, saturated fat, and cholesterol exceeded the standardized meal guidelines of no more than 30% total fat, 10% saturated fat and 33% recommended daily intake of cholesterol (300 milligrams).

Objective 3: Reassess soldiers' satisfaction and food selection and consumption of the IMT menu standards after three weeks of IMT menu implementation.

Three weeks after implementing IMT menu standards, the survey assessing overall satisfaction and meal acceptability, and food selection and nutrient intakes evaluations were repeated. Participants' overall satisfaction (3.9 ± 1.0) and the mean score of all items relating to service quality (3.6 ± 1.2) remained above neutral. Soldiers' return intentions were likely (3.9 ± 1.1) and overall, found meal offerings to be acceptable (3.6 ± 1.2).

On average, 58% ($SD = 19$) of food selections after the intervention were green labeled items and 18% ($SD = 14$) were red. These percentages again mirrored menu offerings, as 61% of 78 menu items offered under IMT standards were labeled green and 17% red. Following the intervention, mean energy intake was 705 ($SD = 226$) kilocalories, of which 31% ($SD = 15$) was from fat and 7% ($SD = 5$) from saturated fat. Participants' consumed 45% ($SD = 13$) of their total kilocalories from carbohydrates (net) and 25% ($SD = 8$) from protein. Total cholesterol and sodium intakes were 133 mg ($SD = 85$) and 1339 mg ($SD = 650$), respectively, and the average intake for dietary fiber was 8 g ($SD = 3$). The mean vitamin A intake was 1887 IU ($SD = 2377$), vitamin C was 31 mg ($SD = 31$), and iron was 5 mg ($SD = 2$). Participants' intakes of total fat and cholesterol exceeded standardized meal guidelines of 30% and 33% daily intake of 300

milligrams, respectively. The percent saturated fat intake fell below the established guideline of 10% and sodium intakes were below 33% MDRI for both men and women.

Objective 4: Evaluate the relationships between reported food behaviors, and actual food selection and consumption based on soldiers' demographic characteristics, nutrition knowledge and attitudes toward health.

Baseline participants' food selections and nutrient intake, as well as results from the quantitative survey administered were used to determine if relationships existed between food behaviors and variables of interest. A majority of participants were male (93%) with less than 4 years of service, possessed a high school education, and were meal card holders not currently enrolled in the Army's weight control program. The groups' mean rank was E-4, age was 25 years ($SD = 6$) and BMI was 26 ($SD = 3$).

Participants' reported that, on average, their typical food selections consisted of 57% ($SD = 27$) green labeled items, 22% ($SD = 27$) red and 21% ($SD = 21$) yellow. The majority of participants reported they eat breakfast 5-6 times per week, eat 1-2 fried foods and fill one-fourth of their plate with fruits/vegetables per meal. A total of 115 (79%) participants reported consuming sugar-sweetened (SS) beverages regularly, with an average weekly consumption of 323 ($SD = 354$) ounces.

Attitudes toward health were evaluated based on endorsement of items within each construct. Endorsed items were those items the participant either agreed or strongly agreed with, which were responses of 4 or 5 on the five-point Likert type scale, while all other responses (neutral, disagree or strongly disagree) were considered not endorsed items. A total of 71% of participants considered their diet to be healthy or very healthy, and 24% stated their diet was neither healthy or unhealthy. At least 90% of participants endorsed items relating to benefits of eating a healthy diet, and, on average, identified two barriers (33%) to eating a healthy diet. A majority of items relating to the importance of eating a healthy (67%) and two of five (40%) cues to eating a healthy diet were endorsed.

Participants' mean nutrition knowledge score was 60% ($SD = 3$), or six of ten questions answered correctly, and two-thirds of subjects answered at least 50% of the answers correctly. Twenty-eight percent of the participants answered at least 80% of the

questions correctly. Pearson correlations, one-way ANOVA, and multiple linear and logistic regression analysis were used to evaluate the relationships between and among variables.

In addition to the objectives, the following null hypotheses were established and tested based on findings of this study. Independent sample t-tests were conducted to determine if significant differences existed in the food selection and nutrient intake as well as the customer satisfaction and meal acceptability scores before and after implementing IMT menu standards.

Hypothesis 1: There will be no difference in soldiers' satisfaction with the military foodservice before and after implementation of the IMT menu standards.

Hypothesis 2: There will be no difference in soldiers' acceptability of the food choices offered before and after implementation of the IMT menu standards.

Hypothesis one and two were supported because the results indicated the mean scores

related to service quality and food quality scores were not statistically significant between meals served under current garrison menu and new IMT menu standards. The mean score of items relating to service quality at baseline were 3.7 ± 1.2 and 3.6 ± 1.2 after implementing IMT menu standards. The mean food quality ratings were 3.5 ± 1.2 with current garrison menu standards and 3.6 ± 1.2 under IMT menu standards. The only significant difference observed between baseline and after implementation was food appeal. The mean score of this question improved from 3.6 ± 1.1 to 3.8 ± 1.0 after implementing the IMT menu standards.

Hypothesis 3: There will be no difference in soldiers' nutrient component of foods selected before and after implementation of the IMT menu standards.

Hypothesis 4: There will be no difference in the nutrient component of foods consumed before and after implementation of the IMT menu standards.

Both null hypotheses three and four were rejected because results showed statistically significant differences in the percentage of red-, yellow-, and green-labeled items between meals served under two menu standards. After implementing healthier IMT menu standards in the non-trainee DFAC, the selection of red-labeled items

decreased (45% vs. 18%) and the selection of green-labeled items increased (36% vs. 58%). Significant decreases in intakes of kilocalories, carbohydrates, total fat, saturated fat, sodium and vitamin C were observed after the intervention. The percent of kilocalories from carbohydrates and protein significantly increased as well. There were no significant differences between the two groups' intakes of cholesterol, dietary fiber, iron and vitamin A.

Hypothesis 5: There will be no difference in soldiers' reported food behaviors based on Soldiers' nutrition knowledge.

Hypothesis 6: There will be no difference in soldiers' nutrient component of foods selected based on soldiers' nutrition knowledge.

Hypothesis 7: There will be no difference in soldiers' nutrient component of foods consumed based on soldiers' nutrition knowledge.

Hypothesis 5 was rejected. The results indicated nutrition knowledge was a significant predictor of typical food behaviors ($p < 0.001$), weekly breakfast consumption ($p < 0.01$), fried food intake per meal ($p < 0.01$), and fruit/vegetable consumption ($p < 0.05$). Nutrition knowledge was not a significant predictor of SS beverage consumption ($p > 0.05$). Hypothesis 6 and 7 were supported. There was no significant correlation found between nutrition knowledge and actual food selection ($p > 0.05$). With the exception of 33% MDRI for protein ($p < 0.05$), there were no significant correlations between 33% MDRI for kilocalories, cholesterol, sodium, iron, vitamins C and A ($p > 0.05$). There were also no significant correlations between nutrition knowledge and total carbohydrates (net), dietary fiber, total fat and saturated fat ($p > 0.05$).

Hypothesis 8: There will be no difference in soldiers' reported food behaviors based on soldiers' attitudes toward health.

Hypothesis 9: There will be no difference in soldiers' nutrient component of foods selected based on soldiers' attitudes toward health.

Hypothesis 10: There will be no difference in soldiers' nutrient component of foods consumed based on soldiers' attitudes toward health.

Hypothesis 8 was rejected because the results indicated attitudes toward health

significantly predicted reported food selections ($p<0.001$), weekly breakfast consumption ($p<0.001$), fried food intake per meal ($p<0.001$) and fruit/vegetable consumption ($p<0.01$). Attitudes toward health was not a significant predictor of SS beverage consumption ($p>0.05$). Hypotheses nine and ten were supported. Soldiers' attitudes toward health were not significant predictors of their actual food selection ($p>0.05$), which was measured as the percentage of green items selected. The results also indicated that overall, attitudes toward health did not significantly predict whether soldiers had better nutrient intakes, which were defined as one-third MDRI or established meal guidelines. With the exception of 33% MDRI for protein ($p<0.01$), attitudes toward health did not significantly predict whether soldiers met 33% MDRI for kilocalories, cholesterol, sodium, iron, and vitamins A and C ($p>0.05$), as well as percent total and saturated fat ($p<0.05$).

Hypothesis 11: There will be no difference in soldiers' reported food behaviors based on soldiers' demographic characteristics.

Hypothesis 12: There will be no difference in soldiers' nutrient component of foods selected based on soldiers' demographic characteristics.

Hypothesis 13: There will be no difference in soldiers' nutrient component of foods consumed based on soldiers' demographic characteristics.

Hypotheses 11, 12 and 13 were all supported. With the exception of a few significant differences observed, overall the results indicated that soldiers' demographic characteristics were not significant predictors of reported food behaviors, food selection or nutrient intakes. It was found that younger soldiers (≤ 21 years) consumed significantly more carbohydrates than soldiers 30 years or older ($p<0.05$). Also, those with a BMI ≥ 30 selected significantly more green items than soldiers with a BMI < 25 ($p<0.05$). Females' consumed significantly less dietary fiber ($p<0.01$) and exceeded 33% MDRI for kilocalories ($p<0.05$) compared to males. When compared to soldiers with less than 10 years of service, soldiers with more than 10 years of service exceeded 33% MDRI for kilocalories and sodium ($p<0.05$), and consumed less of their total kilocalories from carbohydrates ($p<0.01$). Additionally, they consumed more total cholesterol ($p<0.05$), total fat ($p<0.01$) and saturated fat ($p<0.05$). Meal card holders consumed significantly more of their total kilocalories from carbohydrates ($p<0.05$) compared to

cash paying customers and soldiers enrolled in the active duty weight control program consumed significantly less vitamin C compared to those not enrolled ($p < 0.001$). No significant differences were found in food selection and nutrient intakes based on soldiers' education level ($p > 0.05$) and rank ($p > 0.05$).

Implications

Through menu and meal planning, staff training and guidance, and close supervision of production and service; it was logistically possible to implement the IMT menu standards in a non-training environment. A majority of ingredients for new menu items could have been ordered, and staff members were able to apply healthier food preparation methods. Often, including healthier menu choices (e.g., fresh fruits and vegetables, lean meats, etc.) increases food costs, and therefore, foodservice operators may hesitate to include these items. Currently, the Army provides additional funding to those facilities that service IMT soldiers (U.S. Army Food Program, 2012). Therefore, with additional funding, it is possible to change menu standards in non-trainee DFACs without financial hardships.

There are several implications that can be made from the results of this study. First, after the IMT menu standards were implemented for a period of three weeks, it was found that not only did the nutrition quality of patrons' meal selections improve, their nutrition intakes more closely mirrored the MDRI and established meal guidelines. This is a clear indication to military nutrition leaders that IMT menu standards are nutritionally superior to the current garrison menu standards and use of these menu standards in non-trainee DFACs may positively influence the nutrition quality of patrons' meals. By improving nutrition quality of meals provided to the military personnel, military nutrition services may enable service members to improve health and weight status.

Second, the survey results revealed that implementation of the IMT menu standards in non-trainee DFACs did not compromise patrons' perceptions of food and service quality or meal acceptability. Initially, there was a concern that drastic menu changes without incorporating clients' preferences may cause diminished customer satisfaction, which may lead to reduced patronage, especially for non-training soldiers as

they have options to eat elsewhere. This concern was nullified based on the survey results. Diners' perceptions of the overall service remained very positive and it was indicated they were likely to return to the facility to dine again. Additionally, diners found the IMT menu selections to be more appealing than garrison menu selections. Even though there was isolated dissatisfaction voiced by service members for not having short order available every day, overall evaluation was positive. Therefore, military foodservice leadership may consider implementing IMT menu standards for non-trainee DFACS without compromising meal participation rates and undertaking potential risks of DFAC closures.

Third, it was determined that soldiers' nutrition knowledge and attitudes toward health predicted only their reported food behaviors but not actual food behaviors. Patrons' actual food selections quality and nutrient intakes were closely associated with DFAC menu offerings. Additionally, diners' hunger levels prior to lunch services dominantly influenced intakes of energy, total fat, cholesterol and sodium. Although diners' possessed good nutrition knowledge and felt eating a healthy diet and making nutritious food choices was important and beneficial; when it came to making food choices, hunger levels overruled their food behaviors. It was apparent that patrons' made selections based on availability and physiological hunger. Therefore, Army nutrition and health-related initiatives that focus on improving the overall nutrition quality of meal selections offered in the DFAC environment may have the greatest impact on the quality of food selection and consumption of DFAC patrons.

Limitations and Recommendations for Future Research

This exploratory research was conducted with identified delimitations as described below. This study was conducted during one meal period on two specific dates chosen based on menu cycle and the expected number of patrons. Although patrons' behaviors may not drastically change between meals or over multiple days, food behaviors were observed during one meal on one selected day and may have limited generalizability and need to be interpreted with caution. Observing participants' food selections and determining nutrient intake during multiple meals may provide a more accurate

assessment of dining patrons' usual food selection and consumption behaviors. Future studies may evaluate food selection and consumption overall multiple meals and days for a more accurate evaluation.

Due to time and financial constraints, the IMT menu standards were only implemented for a period of three weeks. Implementing IMT menu standards for a longer period of time before assessing food behaviors, and overall satisfaction and acceptability of meal selections may have portrayed a more accurate impact of the menu standard change. It would also reveal the impact of these standards on DFAC utilization rates, which may indicate ultimate measures of patrons' overall acceptability of healthier DFAC meals. Future studies evaluate the longitudinal effects of implementing IMT menu standards and include monitoring DFAC census and food costs to assess the feasibility of implementing IMT menu standards in a non-training environment.

Due to the logistical challenges associated with changing beverage options for only a short period of time and the DFAC management staff's concern with the potential negative impact on customer satisfaction, beverage choices were not changed to meet IMT standards. Current IMT standards do not allow carbonated beverages, regardless of sugar contents, and allow only low-fat/non-fat milk, water, regular and no-sugar added vitamin/mineral enhanced beverages (e.g., PowerAde), unsweetened iced tea, decaffeinated coffee, hot tea, hot chocolate, and 100% fruit juices (U.S. Army Food Program, 2012). The DFAC staff was very concerned of this change and unwilling to make this change because their patrons consume a large amount of carbonated beverages, and removing these beverages from the DFAC would cause major dissatisfaction of their patrons.

In addition, DFAC management staff was also concerned about changing breakfast items to meet the IMT menu standards as they expected negative consequences on DFAC census. Therefore, only lunch and dinner food choices were modified to comply with IMT menu standards. Full implementation of IMT menu standards at all meals would reveal true impact of these changes. Future studies may explore full implementation of IMT menu standards, keeping in mind that these non-training soldiers have other options for their meals. If DFAC utilization rates fall below unsustainable

levels, the effectiveness of such intervention will be minimized and more DFACs may fact the challenge of closure.

Although beverage consumption has a large impact on total nutrient intake, due to the complexity of data collection in an “all-you-can-eat” DFAC where soldiers are allowed to continue refilling their beverages, this study did not address nutrient quality related to beverage consumption. Future studies may include beverage consumption, types an amount of beverages consumed, to more accurately assess nutrient intakes of non-training soldiers.

Lastly, this study did not address potential Hawthorne effects and the nonresponse bias. Respondents may have changed their food selection and consumption behaviors due to the presence of researchers and research assistants. The anonymity of research procedures and location of photography stations may have helped participants feel less conscientious about their food choices, but it is difficult to determine the impact the presence of researchers had on soldiers’ behaviors. In addition, because the research participants were recruited on a voluntary basis, data from those who did not choose to volunteer (roughly three times of those who participated in the study) were not reflected in this study. Therefore, future studies may need to take these into consideration when developing research protocol.

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Appendix A - Kansas State University IRB Approval

TO: Junehee Kwon
HMD
108 Justin Hall

Proposal Number: 6664

FROM: Rick Scheidt, Chair *for June 23 Ave-B*
Committee on Research Involving Human Subjects

DATE: 04/23/2013

RE: Approval of Proposal Entitled, "Feasibility and Effectiveness of Healthy Menu changes for Non-trainee Military Dining Facilities."

The Committee on Research Involving Human Subjects has reviewed your proposal and has granted full approval. This proposal is **approved for one year from the date of this correspondence, pending "continuing review."**

APPROVAL DATE: 04/25/2013

EXPIRATION DATE: 04/25/2014

Several months prior to the expiration date listed, the IRB will solicit information from you for federally mandated "**continuing review**" of the research. Based on the review, the IRB may approve the activity for another year. **If continuing IRB approval is not granted, or the IRB fails to perform the continuing review before the expiration date noted above, the project will expire and the activity involving human subjects must be terminated on that date. Consequently, it is critical that you are responsive to the IRB request for information for continuing review if you want your project to continue.**

In giving its approval, the Committee has determined that:

- ☒ There is no more than minimal risk to the subjects.
☐ There is greater than minimal risk to the subjects.

This approval applies only to the proposal currently on file as written. Any change or modification affecting human subjects must be approved by the IRB prior to implementation. All approved proposals are subject to continuing review at least annually, which may include the examination of records connected with the project. Announced post-approval monitoring may be performed during the course of this approval period by URCO staff. Injuries, unanticipated problems or adverse events involving risk to subjects or to others must be reported immediately to the Chair of the IRB and / or the URCO.

Appendix B - Military IRB Approval



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
MADIGAN ARMY MEDICAL CENTER
9040 JACKSON AVENUE
TACOMA, WASHINGTON 98431-1100

MCHJ-CLI

12 August 2013

MEMORANDUM FOR MAJ Bethany Deschamps, SP, U.S. Army Medical Department Center & School, PhD Candidate, Kansas State University

SUBJECT: No IRB review required for Protocol Entitled - "Feasibility and Effectiveness of Healthy Menu Changes for Non-Trainee Military Dining Facilities"

Principal Investigator: Junchee Kwon, PhD, Associate Professor, Hospitality Management and Dietetics (HMD), Kansas State University

IRBNet #387861-1

1. You have submitted a request that a determination be made if the research you plan to conduct at the 1st Armored Brigade Combat Team's dining facility, Fort Riley, Kansas, engages the Western Regional Medical Command Assurance, so that review and approval by the Madigan Institutional Review Board is required for this research. The purpose of this letter is to inform you that the WRMC Assurance is not engaged in the research, and that no Madigan IRB review is therefore required.
2. Your research focuses on assessing Fort Riley Soldiers' food choices, nutrient consumption, and satisfaction with garrison and IMT (Initial Military Training) menu options using a quantitative survey and digital photography methods.
3. You have indicated that no military member at Fort Riley or employee of the dining facility is involved in any form data collection process under this research protocol.
4. You have also obtained a supportive Memorandum of Understanding between 1st Armored Brigade Combat Team and 187th Medical Battalion, 32D Medical Brigade, signed by COL John Reynolds III, Commander, which allows access to the dining facility on Post and recruitment of Soldiers as research participants.
5. Your study has also been reviewed by the Committee on Research Involving Human Subjects, University Research Compliance Office, Kansas State University, and approved as a minimal risk human use research protocol on 23 April 2013.
6. Please note that the DoD Instruction 3216.02 (08 Nov 2011), states the following regarding the engagement of an institution, in full:

Engaged in research involving human subjects. An institution is engaged in research involving human subjects when its personnel are conducting activities covered by section

SUBJECT: No IRB review required for Protocol Entitled - "Feasibility and Effectiveness of Healthy Menu Changes for Non-Trainee Military Dining Facilities"

219.101(a) of Reference (c) and this Instruction. An institution that is funding, providing equipment, providing access to or information about potential human subjects (but not recruiting human subjects), providing data or specimens (either identifiable or not), or overseeing the research from a regulatory or compliance standpoint is not engaged in the research involving human subjects (but is supporting the research (see "DoD-supported research involving human subjects")).

(Underlining in original.)

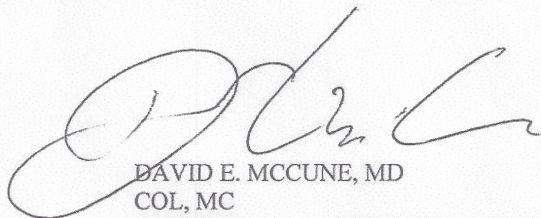
DoDI 3216.02, Glossary, Part II, Definitions, p. 35.

The DoDI may be accessed online at:

<http://www.dtic.mil/whs/directives/corres/pdf/321602p.pdf>

7. Based on the DoDI, in the opinion of the Chief, Department of Clinical Investigation, the 1st Armored Brigade Combat Team and 187th Medical Battalion, 32D Medical Brigade, Fort Riley, Kansas are not engaged in this research because no military member is recruiting military personnel into this research. Consequently, the Madigan IRB is not implicated in this research.

8. The point of contact for this matter is COL David E. McCune, Chief, Department of Clinical Investigation. You may reach COL McCune at 253-968-1160, or by e-mail at: david.e.mccune.mil@mail.mil.



DAVID E. MCCUNE, MD

COL, MC

Chief, Department of Clinical Investigation
Madigan Army Medical Center

Appendix C - Comparison of Garrison and IMT Menu Standards

LUNCH/DINNER Garrison Menu Standards	LUNCH/DINNER IMT Menu Standards
<p>Soup:</p> <ul style="list-style-type: none"> One soup, either cream or broth based. 	<p>Soup (optional):</p> <ul style="list-style-type: none"> One reduced sodium soup per day - cream or broth based - based on customer demand and/or to complement meal.
<p>Entrees:</p> <ul style="list-style-type: none"> Minimum 2 main entrée choices (three desirable) One entrée will be prepared by either baking or roasting. 	<p>Entrees:</p> <ul style="list-style-type: none"> Minimum of two main entrees (three desirable) At least one entrée will be non-pork. All entrées will be prepared by either baking, grilling or roasting and served without added fat Deep fat frying is not an acceptable preparation method. Vegetarian or meatless entrée option will be offered to the degree requested by the customer. Vegetarian entrees that are rice, pasta, or potato based may be served as side items in smaller/ half sized portions. Fish served at a minimum of three times per week as a main entrée (at least one time at lunch and two times at dinner). At least one fish high in omega 3 (salmon, tuna, trout, herring, mackerel, sardines) will be served per week. Only lean ground beef and lean ground turkey (fat content not to exceed 10%) with no fillers or extenders.
<p>Entrée Sides:</p> <ul style="list-style-type: none"> One or more appropriate sauce or gravy to accompany entrée A choice of potato and an additional starch Two dark green or deep yellow cooked vegetables. One additional vegetable is optional. Three bread types will be the minimum plus one selection of hot rolls, cornbread, garlic bread, or biscuits will be offered to complement entrée. 	<p>Entrée Sides:</p> <ul style="list-style-type: none"> One or more sauces or gravies to accompany entrees (only if appropriate) and served on the side unless integral part of the recipe. Potato and starch choice cooked using lower fat preparations methods (baked, grilled, etc.). Deep fat frying or cooking in oil is not an acceptable preparation method. Pasta must be whole grain or nutrient enriched. When rice is an option, use multigrain or wild rice when appropriate to recipe or to complement menu. At least one side item should not be prepared/served in a cream sauce. Two hot vegetables per meal, one of which must be non-starchy and a good source of vitamin A or vitamin C (colorful, dark leafy and deep yellow, orange and red vegetables including carrots, squash, tomatoes, zucchini, spinach, greens, and broccoli). One additional vegetable is optional.

	<ul style="list-style-type: none"> • Legumes and beans served at least three times per week. • No more than one starchy vegetable at lunch and dinner meals. Starchy vegetables include corn, peas (black-eyed, green), beans (baked beans, black beans, chick peas, garbanzo, kidney, lima, navy, pinto refried beans). • Three bread types will be available. All sliced bread must be whole grain/whole wheat type (white with whole grains or whole wheat with at least 2.5 g fiber per serving) and at least one bread offered is fortified with at least 15% calcium (150 mg), 6% folate (16 mcg), and 4% iron (0.72 mg). • One selection of hot rolls, cornbread, garlic bread, or biscuits will be offered to complement entrée.
Fruit: <ul style="list-style-type: none"> • Two Choices of Fresh Fruit 	Fruit: <ul style="list-style-type: none"> • Two Choices of fresh fruit • One choice of dried fruit without added sugars • Precut (cut-up pieces or sectioned) fruit
Accompaniments & Condiments: <ul style="list-style-type: none"> • Margarine or butter pats, choice of two or more spreads, plus jam or jelly • Sliced tomatoes, onions, pickles, lettuce leaves, catsup, mayonnaise, mustard, relish, and salad dressing 	Accompaniments & Condiments: <ul style="list-style-type: none"> • Trans fat free (zero grams trans fat per serving) spread (instead of margarine) or butter pats • Choice of two or more spreads, plus jelly or jam, salsa, peanut butter, and trail mix • Sliced tomatoes, onions, pickles, lettuce leaves, catsup, mayonnaise, mustard, relish, and salad dressing
Yogurt: <ul style="list-style-type: none"> • Two flavors of individual or bulk low-fat yogurts 	Yogurt: <ul style="list-style-type: none"> • Two flavors of low fat (less than 3 g of fat per serving) individual yogurt (at least 4 oz. but no more than 8 oz.) or bulk low fat (less than 3 g of fat per serving) yogurt
Dessert (minimum): <ul style="list-style-type: none"> • Four different dessert choices daily (such as cookies, cake, pie, low-fat ice cream/yogurt, gelatin and/or pudding) 	Dessert (minimum): <ul style="list-style-type: none"> • Four different low-fat dessert choices as canned fruit (light syrup or packed in own juice), angel food cake, bar cookies (less than 150 calories and less than 5 g of fat per serving) small low-fat muffins (less than 30% of calories from fat, and at least 1 g fiber), fruit parfaits, fruit salad, low-fat ice cream/frozen yogurt (less than 4 g of fat and less than 120 calories per serving), gelatin and/or pudding (less than 30% of calories from fat) • Pastry items such as cake, cookies, and pie will only be included in holiday menus or end of cycle celebratory meal.

<p>Short Order:</p> <ul style="list-style-type: none"> • Grilled hamburgers, cheeseburgers, and frankfurters. • French fries, onion rings, and assorted chips and pretzels. 	<p>Short Order:</p> <ul style="list-style-type: none"> • Grilled hamburgers (precooked at least 85/15 ground beef, from raw 90/10 lean ground beef), cheeseburgers, grill cheese (made on whole grain bread with no butter on bread, use non-stick cooking spray on grill) • Specialty sandwiches • Frankfurters or link type meats will not be served. • Baked French fries to include sweet potato fries, assorted baked chips/crackers, and pretzels
<p>Deli Bar (consist as a minimum of):</p> <ul style="list-style-type: none"> • Three deli meat choices (ham, turkey, and roast beef) • Two cheese choices (American and Swiss) • Three different choices of bread or rolls (recommended to be described as “hearty” or “earth grain”. 	<p>Deli Bar (consist as a minimum of):</p> <ul style="list-style-type: none"> • Three lean deli meat choices (lean ham, lean turkey, and lean roast beef). Lean Ham per 86 g (3 oz.) serving less than 95 calories, 3.5 g fat, and less than 1000 mg sodium Lean Turkey per 86 g (3 oz.) serving less than 85 calories, 1.5 g fat, and less than 900 mg sodium. Lean Roast Beef per 86 g (3 oz.) serving less than 105 calories, 3 g fat, less than 1050 mg sodium. • Two sliced cheese choices (American, Cheddar/Colby, Provolone, Pepper/Monterey Jack, or Swiss). All sliced cheeses per 28 g (1 oz.) serving will be less than 9 g fat, less than 6 g saturated fat, less than 350 mg sodium, and at the minimum 15% DV (150 mg) for calcium. Reduced fat and low fat cheeses are acceptable. Imitation and fat free cheeses are not acceptable. • Three different bread choices (whole grain/whole wheat type breads or rolls [white with whole grains or whole wheat with at least 2.5 grams fiber per serving])
<p>Salad Bar:</p> <ul style="list-style-type: none"> • Leafy green salad • Ten fresh toppings such as carrots, radishes, tomatoes, cucumber, green pepper, onion, mushrooms, etc. • Five separate salad dressings choices (regular), and 2 low-fat or fat-free. • Oil and vinegar 	<p>Salad Bar:</p> <ul style="list-style-type: none"> • Leafy green salad - 50% is dark green leafy vegetables (such as romaine or spinach) • Second leafy green salad - 50% is dark green leafy vegetables with hard vegetables (such as broccoli, cauliflower, carrots, and radishes) • Ten toppings such as tomatoes, cucumber, green pepper, onion, mushrooms (canned), low fat cottage cheese, legumes, pumpkin seeds, etc. • At least one legume and either pumpkin or sunflower seeds offered as a topping • Seven separate salad dressings choices-two choices of regular salad dressing and five choices of low-fat salad dressing • A selection of salad oil such as canola, olive,

	sesame, or blends of these oils, and vinegar such as apple cider, balsamic, red, or white vinegar <ul style="list-style-type: none"> • Mayonnaise based salads must use lower fat mayonnaise or lower fat salad dressings.
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Note. DV = daily value; mcg = microgram; IU = international units; g = gram; mg = milligram; Adapted from United States Army Quartermaster School Joint Culinary Center of Excellence (JCCoE). (2012). *IMT Menu/Product Standards Final*. Retrieved from http://www.quartermaster.army.mil/jccoe/Operations_Directorate/QUAD/nutrition/IMT_Menu_Standards.pdf.

Appendix D - Informed Consent

INFORMED CONSENT

PROJECT TITLE: Feasibility and Effectiveness of Healthy Menu Changes for Non-Trainee Military Dining Facilities

APPROVAL DATE OF PROJECT: 4/23/2013

EXPIRATION DATE OF PROJECT: 4/23/2014

PRINCIPAL INVESTIGATOR: CO-INVESTIGATOR(S): Dr. Junehee Kwon: Major Bethany Deschamps

CONTACT AND PHONE FOR ANY PROBLEMS/QUESTIONS:	Dr. Junehee Kwon	Major Bethany Deschamps
	(785)-532-5369	(785)-340-2811
	jkwon@ksu.edu	deschamp@k-state.edu

IRB CHAIR CONTACT/PHONE INFORMATION:

Rick Scheidt, Chair, Committee on Research Involving Human Subjects, 203 Fairchild Hall, Kansas State University, Manhattan, KS 66506, (785) 532-3224.

Jerry Jaax, Associate Vice President for Research Compliance and University Veterinarian, 203 Fairchild Hall, Kansas State University, Manhattan, KS 66506, (785) 532-3224.

SPONSOR OF PROJECT: Kansas State University

PURPOSE OF THE RESEARCH: This study assesses soldiers' food and nutrient consumption, and their satisfaction with current and new healthier menu options.

PROCEDURES OR METHODS TO BE USED: *Self-administered questionnaire and digital photography methods. We will ask you to have your food tray photographed before meal consumption, and to complete and submit a short questionnaire before leaving the dining facility.*

LENGTH OF STUDY: One lunch meal (≈ 30-45 minutes)

RISKS ANTICIPATED: *Researchers will be located in the dining facility self-service area (i.e. salad bar), directly observing what and how much food you are placing on your tray, and will also be taking photographs of your food tray at the photograph stations. Either of these two activities could potentially make you feel uneasy or self-conscious about your food choices.*

BENEFITS ANTICIPATED: This research is important to determine how much the IMT menu standards impact non-basic training soldiers' nutrient consumption and how well healthy food choices are accepted in our military dining facilities. The outcome of the research will help establish the appropriate balance of health and customer satisfaction within military dining facilities.

EXTENT OF CONFIDENTIALITY: Survey information and photographs will remain unanimous and kept confidential. Participants' names, individual survey responses, and food tray photographs will not be identified.

TERMS OF PARTICIPATION: I understand this project is research, and that my participation is completely voluntary. I also understand that if I decide to participate in this study, I may withdraw my consent at any time, and stop participating at any time without explanation, penalty, or loss of benefits, or academic standing to which I may otherwise be entitled. I verify that my signature below indicates that I have read and understand this consent form, and willingly agree to participate in this study under the terms described, and that my signature acknowledges that I have received a signed and dated copy of this consent form.

Participant Name: _____

Participant Signature: _____ **Date:** _____

Witness to Signature: (project staff) _____ **Date:** _____

Appendix E - Quantitative Survey

Military Dining and Nutrition Survey

The completion of this questionnaire serves as your informed consent as a participant in research. Confidentiality of your responses is guaranteed, and only summarized data will be published in research journals.

List a **four**-digit number that is easy for you to remember (e.g., last four digits of cell phone number):

____ - ____ - ____ - ____

1. How hungry were you when you came into the dining facility to eat lunch today? Please rate your hunger level using the scale below. (circle only **ONE** number)

(More hungry) 1 ---- 2 ---- 3 ---- 4 ---- 5 ---- 6 (Less hungry)

1 = greatest imaginable hunger
2 = extremely hungry
3 = very hungry
4 = moderately hungry
5 = slightly hungry
6 = neither hungry nor full

2. In your opinion, how healthy is your diet? (circle only **ONE** answer)

A. very unhealthy B. unhealthy C. neutral D. healthy E. very healthy F. I don't know

3. Below are three groups of different lunch/dinner menu choices. Which food items **BEST** represent what **YOU** would **TYPICALLY** choose? Circle only **ONE** item per food group and write in a typical choice if none of the listed applies.

Food Group

Entrée:	Grilled Chicken	Roast Beef	Cheeseburger	Other: _____
Starch:	White Rice	French Fries	Whole Grain Pasta	Other: _____
Vegetable:	Glazed Carrots	Steamed Broccoli	Onion Rings	Other: _____
Dessert:	Angel Food Cake	Cookie	Fresh Fruit	Other: _____

4. Typically, how many **DAYS** per week do you eat breakfast? (circle only **ONE** answer)

A. 0 B. 1-2 C. 3-4 D. 5-6 E. 7 F. I don't know

5. Did you eat breakfast **TODAY**? (circle only **ONE** answer)

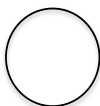
YES **NO**

6. How many different **FRIED** items do you **typically** choose for a lunch or dinner meal? (circle only **ONE** answer)
(e.g., buffalo wings with French fries equals two fried items)

A. None B. One C. Two D. Three E. Four F. I don't know

7. At a typical meal, how much of your plate is filled with fruits and/or vegetables? (circle only **ONE** answer)

A. None B. 1/4 C. 1/2 D. 3/4 E. All F. I don't know



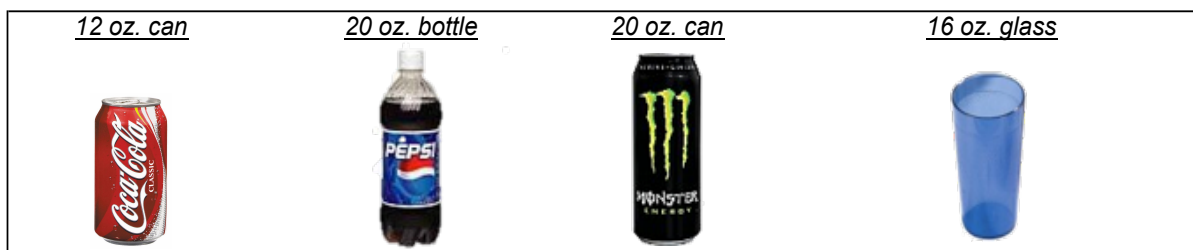
8. Do you consume soda, electrolyte beverages (e.g., gatorade/powerade), fruit juice, energy drinks or other sugar-sweetened beverages? (circle one answer) **YES NO (GO TO QUESTION #10)**

(IF YOU ANSWERED "NO" TO THIS QUESTION, PLEASE SKIP QUESTION #9)

9. We are interested in knowing the amount of sugar-sweetened beverages (soda, energy drinks, kool-aid, puches, etc.) you consume. Please refer to the example answer and photos provided below when completing this question.

EXAMPLE: If you drink three 12-ounce cans of regular soda per day, one 20-ounce energy drink per week but no 16-ounce glasses of sweetened beverages, this is how the question is answered:

ANSWER: Typically, I drink 3 12-ounce containers of sweetened beverages per day / week and 1 20-ounce container per day / week and 0 16-ounce glass per day / week.



ANSWER: Typically, I drink _____ 12-ounce containers of sweetened beverages per **DAY / WEEK**, and _____ 20-ounce containers per **DAY / WEEK**, and _____ 16-ounce glasses per **DAY / WEEK**.

10. List all the beverage(s) you consumed with your lunch meal **TODAY**: 1. _____
2. _____
3. _____
4. _____

11. Given a choice, would you continue to eat meals in this dining facility if the beverage(s) you chose today was not available?

(Please circle only **ONE** answer) **YES NO I DON'T KNOW**

12. How satisfied or dissatisfied will you feel if carbonated beverages (e.g., sweetened or sugar-free sodas) are eliminated from this dining facility? (Please circle only **ONE** answer)

Extremely Dissatisfied Dissatisfied Neutral Satisfied Extremely Satisfied

For questions 13, circle the option on the right that **BEST** describes your level of importance for each statement. (circle only **ONE** option for each statement)

The following statement refers to the term healthy diet. A healthy diet is defined as, "a diet that is low in unhealthy fats, sodium, cholesterol, and sugar, and high in fiber, fresh fruits and vegetables, healthy fats and lean protein".

13. Eating a healthy diet will:	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	I Don't Know
a. improve physical performance.	SA	A	N	D	SD	IDK
b. help maintain a healthy body weight.	SA	A	N	D	SD	IDK
c. decrease body fat percentage.	SA	A	N	D	SD	IDK
d. improve overall health.	SA	A	N	D	SD	IDK

For question 14, circle the option on the right that **BEST** describes your level of importance for each statement.
(circle only **ONE** option for each statement)

14. <i>It is important for me to choose a diet that is:</i>	Very Important	Important	Neutral	Unimportant	Very Unimportant	I Don't Know
a. low or moderate in salt or sodium.	VI	I	N	U	VU	IDK
b. low in saturated fat.	VI	I	N	U	VU	IDK
c. low in total fat.	VI	I	N	U	VU	IDK
d. low in cholesterol.	VI	I	N	U	VU	IDK
e. low in sugar.	VI	I	N	U	VU	IDK
f. high in fiber.	VI	I	N	U	VU	IDK
g. containing a variety of foods.	VI	I	N	U	VU	IDK
h. high in fruits and vegetables.	VI	I	N	U	VU	IDK
i. lower in calories.	VI	I	N	U	VU	IDK

For questions 15-17, circle the option on the right that **BEST** describes your level of agreement with each statement. (circle only **ONE** option for each statement)

*The following statements refer to the term **healthy food choices**. Healthy food choices are those that support a healthy diet.*

15. <i>It is difficult to make healthy food choices because:</i>	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	I Don't Know
a. healthy food is less convenient.	SA	A	N	D	SD	IDK
b. healthy food is unavailable in the dining facility.	SA	A	N	D	SD	IDK
c. healthy food is unaffordable.	SA	A	N	D	SD	IDK
d. I lack enough nutrition knowledge to make healthy food choices.	SA	A	N	D	SD	IDK
e. others around me make unhealthy food choices (e.g., friends, family, co-workers).	SA	A	N	D	SD	IDK
f. I don't desire to eat healthy food.	SA	A	N	D	SD	IDK
16. <i>In general, I make healthy food choices.</i>	SA	A	N	D	SD	IDK
17. <i>I would make healthy food choices if it is:</i>						
a. identified or labeled as healthy (e.g., go-for-green labels or food package labeled "100% whole grain).	SA	A	N	D	SD	IDK
b. recommended by a doctor or other healthcare professional.	SA	A	N	D	SD	IDK
c. recommended by a work supervisor (e.g., First Sergeant).	SA	A	N	D	SD	IDK
d. recommended by a friend or colleague.	SA	A	N	D	SD	IDK
e. recommended by a family member.	SA	A	N	D	SD	IDK

The following questions evaluate your knowledge and understanding of basic nutrition concepts. Please read and answer the questions to the best of your ability. (circle only ONE answer)

18. According to the USDA's "Choose My Plate" guidelines, approximately how much of your plate should be filled with fruits and/or vegetables?
A. 1/4
B. 1/3
C. 1/2
D. 3/4
E. I don't know
19. Which of the following food or beverage items is considered the **BEST** source of complex carbohydrates?
A. whole grain pasta
B. orange juice
C. honey
D. banana
E. I don't know
20. Which nutrient would be the **BEST** to consume prior to engaging in physical activity lasting approximately an hour (e.g., PRT)?
A. protein
B. fat
C. complex carbohydrates (e.g., oatmeal)
D. simple carbohydrates (e.g., Kool-aid)
E. I don't know
21. Which of the following foods would be considered the **BEST** low-calorie, nutrient-rich food choice?
A. spinach
B. baked potato chips
C. large whole wheat bagel
D. sugar-free Jell-O
E. I don't know
22. Which meal is **LOWER** in total fat?
A. Meal #1
3 ounces baked chicken
1 serving cooked spinach
1 serving angel food cake
B. Meal #2
1 grilled cheeseburger
1 ounce stir-fry mushrooms and onions
1 small piece of chocolate cake with frosting
C. I don't know
23. Which of the following alcohol servings contains the **MOST** calories?
A. one restaurant/bar serving of a mixed drink (e.g., margarita, screwdriver)
B. one ounce (one shot) of liquor (e.g., whiskey, rum)
C. four ounces of red wine
D. one 12-ounce bottle of regular beer
E. I don't know
24. Which of the following food choices is the **BEST** source of omega-3 fatty acids?
A. chicken breast
B. whole wheat bread
C. salmon
D. butter
E. I don't know
25. Which of the following food items is **LOWEST** in saturated fat?
A. barbeque beef ribs
B. pork bacon
C. whole milk
D. grilled skinless chicken breast
E. I don't know
26. Which of the following choices would be considered **SAFE** weight loss?
A. 1/2 -1 pound per week
B. 1 - 2 pounds per week
C. 3 - 5 pounds per week
D. As many pounds as possible each week
E. I don't know
27. Which meal is **LOWER** in saturated fat?
A. Meal #1
3 ounces pork tenderloin
1/2 cup brown rice
2 cups salad greens with vinaigrette dressing
B. Meal #2
3 ounces beef pot roast
1 serving French fries
1 serving buttered corn
C. I don't know

STOP!!

PLEASE COMPLETE THIS PORTION OF THE SURVEY **AFTER** YOU FINISH YOUR MEAL.

PLEASE COMPLETE THIS PAGE AFTER YOU FINISH YOUR LUNCH MEAL

For questions 28-42, circle the option on the right that **BEST** describes your level of agreement with each statement regarding your overall dining experience **TODAY**. (circle only **ONE** option for each statement).

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	I Don't Know
28. The staff was friendly and courteous.	SA	A	N	D	SD	IDK
29. I received an accurate food order/request.	SA	A	N	D	SD	IDK
30. The staff promptly took my food order/request.	SA	A	N	D	SD	IDK
31. I received my food in a timely manner.	SA	A	N	D	SD	IDK
32. The staff accommodated my special food request(s). (circle only if applicable)	SA	A	N	D	SD	IDK
33. The overall service provided was excellent.	SA	A	N	D	SD	IDK
34. The food served today appeared fresh.	SA	A	N	D	SD	IDK
35. The food looked appetizing.	SA	A	N	D	SD	IDK
36. The food I ordered was flavorful.	SA	A	N	D	SD	IDK
37. The temperature of the food was appropriate.	SA	A	N	D	SD	IDK
38. The self-service food items were accessible.	SA	A	N	D	SD	IDK
39. I am satisfied with the number of menu choices available.	SA	A	N	D	SD	IDK
40. The portion sizes of food I received were adequate.	SA	A	N	D	SD	IDK
41. There were healthy menu options available.	SA	A	N	D	SD	IDK
42. I would willingly return here again to eat a meal.	SA	A	N	D	SD	IDK

43. How full are you after finishing your meal today? Please rate your satiety level (e.g., satisfaction of fullness) using the scale below. (circle only **ONE** number).

(Less Full) 1 ---- 2 ---- 3 ---- 4 ---- 5 ---- 6 (More full)

1 = neither hungry nor full
 2 = slightly full
 3 = moderately full
 4 = very full
 5 = extremely full
 6 = greatest imaginable fullness

44. What is your age? _____ years

45. What is your height? _____ inches

46. What is your weight? _____ pounds

47. What is your gender? (circle **ONE**) **MALE** **FEMALE**

48. What is your military pay grade/rank? E - _____ or O - _____ Other: _____

49. What is the highest level of education you have **COMPLETED**? (check only **ONE** answer)

____ High school (GED) ____ Associate's Degree Other: _____
 ____ Bachelor's Degree ____ Graduate degree or higher

50. How many total years of military service (all branches) have you **COMPLETED**? _____ years

51. Are you currently a meal card holder? (circle **ONE**) **YES** **NO**

52. Are you currently enrolled in the Army's weight control program? (circle **ONE**) **YES** **NO**

**THANK YOU SO MUCH FOR YOUR PARTICIPATION.
 HAVE A WONDERFUL AFTERNOON!**

Appendix F - Salad Bar Observation Form

SALAD BAR OBSERVATION FORM

<u>MENU ITEM</u>	Serving Utensil Used	TRAY #1: _____	TRAY #2: _____
Bacon Bits		Bacon Bits	Bacon Bits
Broccoli, florets		Broccoli	Broccoli
Cauliflower, florets		Cauliflower	Cauliflower
Cheese, shredded		Cheese	Cheese
Corn		Corn	Corn
Cottage cheese, low-fat		Cottage Cheese	Cottage Cheese
Croutons		Croutons	Croutons
Cucumber, sliced		Cucumber	Cucumber
Egg, chopped		Egg	Egg
Ham, chopped		Ham	Ham
Lettuce Mix		Lettuce	Lettuce
Mushrooms, canned, sliced		Mushrooms	Mushrooms
Noodles, chow mien		Noodles	Noodles
Olives, black, sliced		Olives, black	Olives, black
Olives, green, whole		Olives, green	Olives, green
Onion, chopped		Onion	Onion
Peppers, green, sliced		Peppers	Peppers
Tomato, cherry		Tomato	Tomato
Turkey, chopped		Turkey	Turkey
Prepared Salad: _____		Prepared Salad	Prepared Salad
Prepared Salad: _____		Prepared Salad	Prepared Salad
Prepared Salad: _____		Prepared Salad	Prepared Salad
Prepared Salad: _____		Prepared Salad	Prepared Salad
Soup of the Day: _____		Soup	Soup
Other: _____		Other: _____	Other: _____
Other: _____		Other: _____	Other: _____
Other: _____		Other: _____	Other: _____
Other: _____		Other: _____	Other: _____

Appendix G - Plate Waste Record Sheet

PLATE WASTE RECORD SHEET

TRAY #: _____		
<u>LEFTOVER FOOD ITEMS</u>	<u>WEIGHT (grams)</u>	<u>NOTES</u>

TRAY #: _____		
<u>LEFTOVER FOOD ITEMS</u>	<u>WEIGHT (grams)</u>	<u>NOTES</u>